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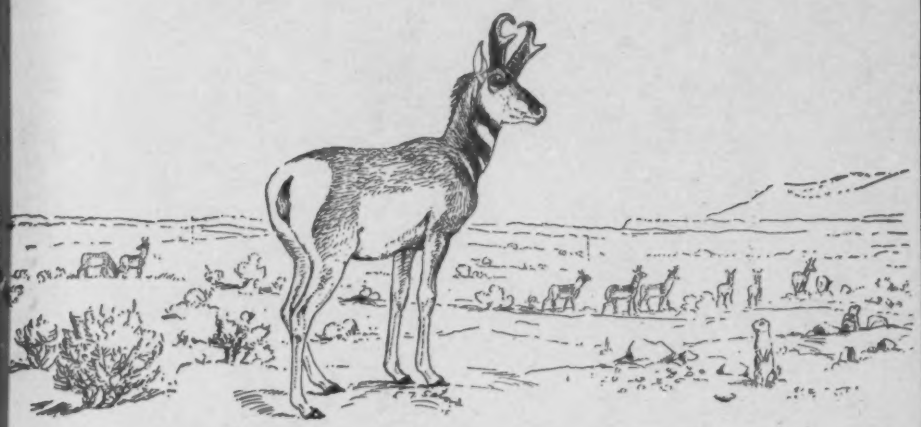

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UNIT CHARACTER VARIATION IN RODENTS[1]

BY L. C. DUNN

Recent progress in the study of the inheritance of coat colors in several species of rodents has revealed a rather striking similarity in the variations which have arisen in distinct species of that order. This similarity is not only a matter of appearance, which is familiar to all students of mammals, but extends as well to the manner of inheritance, and most recently has been found to characterize the localization of the determinants or genes for similar variations in two species. Such identity of cause of the same variation in two or more species indicates that such variations are homologous, and that the species which give rise to them have a relationship of a somewhat different and more intimate kind than that implied in the theory of relationship by common descent.

Before detailing the conditions in the species of rodents which have been studied, some explanation of the evidence and reasoning which underlie the localization of genes is due to the general reader. It is probably recognized by all students of biology that heritable variations arising generally by mutation are transmitted to the offspring in accordance with certain definite rules, known familiarly as Mendel's laws of inheritance. The chief of these laws states that heritable characters are transmitted as discrete units which segregate in the formation of the germ cells. A second principle asserts that the segre-

[1] In this paper, which is to regarded as a cursory survey leading to a consideration of one or two special points rather than as an authoritative exposition of variation in rodents, I have not felt it essential to furnish a detailed bibliography. The necessary references may be found in Castle (1920) and Morgan (1919) as noted in the bibliography, and an excellent survey in Wright (1917), which also considers the physiological and chemical aspects of color variation and inheritance.

gation of the units is independent, resulting in a random distribution of the characters of the parents among their gametes, such that when two units are involved the chances are equal that they will go together or separately. The first principle probably applies to all inheritance. Evidence has been brought forward to show that the factors or genes which represent the visible characters are not discrete but variable, and capable of change by selection, but this evidence has now been found to indicate not variability but plurality of units. The second principle still applies to most cases of inheritance but has been modified by the finding that two or more characters may not always be distributed independently but when entering a cross together may tend to stay together, and when entering a cross separately may tend to remain separate (in different individuals) in inheritance. This peculiarity was first remarked by Bateson (1906) in the case of the inheritance of flower color and pollen shape in sweet peas. In his experiments purple flower (as opposed to red) and long pollen (as opposed to round) appeared to be associated or coupled in crosses so that a marked distortion was evident in the second generation ratio of 9:3:3:1 expected on the usual hypothesis of independent assortment, in favor of the classes (purple-long and red-round) representing the grandparental combinations of these characters. The opposite phenomenon was noted and named repulsion. Later, Morgan in 1910 found the same phenomena while studying inheritance of certain characters which had arisen by mutation in the vinegar fly (*Drosophila melanogaster*). He conceived these two exceptions to Mendel's principle of independent assortment as two aspects of a single phenomenon which he termed *Linkage* or associated inheritance.

The interpretation of these events has constituted one of the great advances of biological science. Sutton, in 1902, suggested that the marked parallelism between the discreteness and assortment of unit characters and the behavior of the chromosomes might be due to the residence in the chromosomes of the determinants or genes representing unit characters. Immediately after Bateson's announcement of coupling, Locke (1906) pointed out the similarity between this new mode of inheritance and the results which might be expected if the coupled characters were determined in one chromosome. The development of this hypothesis, its proof and very important extension and generalization, have been the work of the American biologist T. H. Morgan, and of research workers associated with him, assisted more recently by data gathered by geneticists and cytologists working on many

species of plants and animals. There has resulted from this work the elaboration of the chromosome theory of heredity, for the details of which, and the supporting evidence, the interested reader must be referred to the original works, especially as summarized in two publications of Morgan and his co-workers (1915 and 1919).

For our purpose it is sufficient to note in brief that the theory supposes that the differential representatives of heritable characters are located in the nuclear material of the egg and sperm cells, more precisely in those remarkably constant and individual organizations of chromatin known as chromosomes, which appear at the time of cell division and which probably retain their individuality even in the resting stages of the nucleus. Of the evidence it must be observed that the interpretation and proof of the theory rest entirely on the study of linkage, or associated inheritance. This phenomenon is observed in the tendency which characters exhibit of remaining through several generations in their original combinations, resulting in an alteration of the expected Mendelian ratios based on independent assortment. This tendency may be absolute, in which case linkage is said to be complete. More often it is partial, that is, characters originally associated may separate in a certain proportion of instances, or characters originally separate may become associated. This change in the relationships of genes is known as "crossing-over" and it provides a quantitative measure of the strength of the tendency toward association. In terms of the chromosome hypothesis it is interpreted as an interchange of parts and of the genes which the parts carry, between two members of a chromosome pair, so that two genes originally resident in one chromosome may come to lie in two chromosomes and may thence be distributed to separate gametes and exhibit their effects (unit characters) in different individuals. For any two characters the number of times crossing-over occurs is found to have a characteristic value and this value is stated as the percentage of times crossing-over occurs as evidenced by the frequency of individuals possessing the two characters in the new combination. One other important aspect of these measurable breaks in linkage is that from the linkage strength may be inferred the proportional distance apart of linked genes. From cytological evidence crossing-over is supposed to take place between homologous chromosomes in the hybrid at the time when these chromosomes are intimately twisted one about the other. Breaks resulting in a separation of characters are then supposed on mere physical grounds to be more frequent between genes located far apart in the chromosomes

than between those located near together. The bulk of the evidence indicates that the loci of genes are on the same straight line in any chromosome. Numerical strength of linkage may then be a measure of the exact localization of the genes in the germ plasm, and it is to a consideration of this point that our whole discussion has led. For if the genes for unit characters can be thus localized, a direct comparison of species in which similar variations occur can be made on this point alone, even though the species cannot be crossed.

The study of localization of the genes for unit character variations is attended by numerous limitations. It can only be prosecuted through the experimental breeding of large numbers of organisms, exhibiting numerous variations. It is dependent even under these conditions on the occurrence of linkage, which is by no means common. It is a corollary of the location of genes in chromosomes, that the numbers of groups of linked genes be equal to the number of chromosome pairs present. Where the number of chromosomes is large, and the number of unit variations known is small, the chances are few that any two characters will be found to be localized in one chromosome pair. Even under such limitations, linked genes have been studied in several insects (chiefly *Drosophila*) and plants, and most recently in mammals. The general results of these studies have been to confirm the chromosome theory and to increase our knowledge of the localization of genes.

Correlative evidence has come from a brilliant series of cytological investigations on the germ cells of several organisms. It has been established that in the cells of each species are to be found a definite number of chromosomes, characteristic for the species. This number in germ cells is half the number found in the somatic cells, due to the intervention of reducing cell divisions. The chromosomes themselves are in general arranged in pairs of homologues in the somatic cells and in the primordial germ cells, one member of each pair having come from each parent, and this duality again becomes evidenced in the passage of one member of each pair into the germ cells which form the next generation. The individual chromosomes are sometimes recognizable by peculiarities of shape, etc. More often their constancy is of numbers only. These cytological results have been made possible only by a high development of technique and can provide even when greatly extended only correlative evidence on the localization of genes. The geneticist or cytologist no more expects to behold the gene of which his literature is full than the chemist hopes to see the atom of which he speaks with unabated glibness. The gene remains useful as a concept and a notation, doubly so now that it includes an idea of spatial definition.

The above is a somewhat pretentious introduction to a discussion which adds so little to the matters mentioned in the opening paragraph, and yet I hope it has not been without interest to those engaged in the study of mammalian variation and evolution. The facts and theories discussed are to have an important place in general biology, and one may perhaps wish to hear of progress in a field which has tended at times to shut itself off from its fellow branches, by the dialect it has been forced to use.

Perhaps the best way of presenting the evidence on unit variation in color in the Rodentia is to describe the appearance and genetic behavior of each of the principal variations with a short list of the species in which it has been studied, and of the species in which a variation of similar appearance has been reported.[2] Where the inheritance of a variation has not been determined by experimental breeding this fact is noted by an asterisk. This list makes no claim to completeness except in the cases of variations which have been studied experimentally. The rest of the variations have been reported as occurring in the wild or are represented by specimens in the Museum of Comparative Zoology at Harvard University, the Museum of the Boston Society of Natural History, or the American Museum of Natural History of New York. I am indebted to Dr. Glover M. Allen of the Boston Society of Natural History for help in gathering this part of the material, and for helpful suggestions and criticism of this paper.

All of the variations listed appear to have arisen, probably by mutation, from the primitive coat color of all rodents, the dull protective grey pattern known as "agouti." This color, which is actually a mosaic, is due to the presence of three pigments, black, brown and yellow, distributed uniformly over the dorsal surface of the animal. Each dorsal hair is characterized in general by an area of black next to the skin in which brown granules are mingled and generally masked by the black, followed by a band of diffuse yellow. The apex of the hair is typically black. The belly is always of a lighter shade than the dorsum, due to a lesser concentration of black pigment and a wider area of pale dusky yellow in the hairs. The "agouti" coat is seen in a typical form in the familiar wild house mouse (*Mus musculus*), the common rat of this country (*Rattus norvegicus*), etc. It characterizes the wild type forms of all the species included in the following list.

[2] This proceeding may be expected to lead to some errors since similarity of appearance is not always evidence of similarity in germinal constitution, but in the absence of breeding data we must use the only criterion available.

ALBINO

From this wild type distinct graded losses of pigment have taken place, the extreme of which is complete albinism, or entire absence of pigment, leaving the fur clear white and the eyes pink. The pinkness of the eye is due to the absence of pigment in the iris, which is typically colored by black or brown pigment granules, so that the blood in the capillaries on the retina is directly visible. This variation is to be sharply distinguished from "partial albinism," a term which has been applied, unwisely it now appears, to the occurrence of white spotting in animals whose eyes retain their full color. The color of the eyes is an important point of distinction between complete albinos and spotted animals. Cases of true albinism have been reported in nearly all the families of rodents. Data from only five of the commonest families are given here, the families being listed roughly in the order of their relationship from the more primitive to the more specialized.[3]

Leporidæ—	Oryctolagus cuniculus—European "rabbit."
Sciuridæ—	*Marmota monax—Woodchuck.
	*Sciurus hudsonicus—Northern red squirrel.[4]
	*Sciurus carolinensis leucotis—American gray squirrel.
	*Tamias striatus lysteri—Chipmunk.
Muridæ—	Mus musculus—House mouse.
	Rattus norvegicus—Common rat.
	*Microtus pennsylvanicus—Meadow vole.
	*Fiber zibethicus—Muskrat.
	Peromyscus leucopus noveboracensis—Deer mouse.
Hystricidæ—	*Erethizon dorsatum—Canada porcupine.
Caviidæ—	Cavia cobaya—Guinea-pig.

The inheritance of the albinism has been studied in the rabbit, the house mouse, the house rat, the deer mouse and the guinea-pig. In all of these it is due to a gene which acts as a Mendelian recessive to full color. At the same (albino) locus in the germ plasm have occurred other mutations. In the rat, a change in this locus has produced both

[3] I have followed the older order of classification which includes the Leporidæ in the Rodentia.

[4] Through the kindness of Professor Barrows of the Michigan Agricultural College and Prof. W. E. Castle of Harvard University the writer has learned of the capture of a pair of albino red squirrels by A. E. Secord, of Wheeler, Michigan. Breeding experiments to test the inheritance of this variation were to have been attempted but expense and pressure of other work have prevented the writer from undertaking the project. At last reports the squirrels were alive and for sale and it is hoped that they will come into possession of some interested person.

albino and its dominant allelomorph ruby-eyed dilute, in which the reduction of the melanic pigments is visible in the generally lighter tone of black, coupled with a complete absence of yellow. In the guinea-pig three graded variations have occurred: (1) *dilution*, resulting in a reduction of all pigments; (2) *ruby*, resulting in the absence of yellow, and the further reduction of black and brown in fur and eyes to very light shades (probably homologous with the ruby variation in rats); and (3) *Himalayan albinism*, which determines the absence of yellow and the restriction of black and brown to the extremities, ears, nose, feet, and rump, while the eyes are pink. These three conditions are distinct in appearance, do not blend in crosses and are all alternative allelomorphs with full color and with each other. No complete albinism is known in the guinea-pig. In the rabbit two changes have taken place: Himalayan albinism (probably homologous with the Himalayan albinism of guinea-pigs) and albinism. These are allelomorphic with full color and with each other; that is, crosses of full colored animals with albinos produce only full colored young and in the second generation only colored and albinos. The same is true of the cross colored × Himalayan, while the cross Himalayan × albino produces only Himalayan and in the second generation only Himalayan and albino. The occurrence of this variation in several species, its similarities in appearance and in inheritance, and finally the production at the same locus as indicated by allelomorphism of other similarly appearing variations indicate that the particular locus in the chromatin at which these mutations have occurred is common to a number of widely different species and although such a statement cannot be proved except by a study of linkage relations between this and other common loci, it seems very probable that albinism is homologous variation throughout the rodents and in the species studied is due to homologous genes.[5]

PINK-EYE

This name has been applied by geneticists to a unit character in rodents which is not a form of albinism, as the pinkness of the eye might indicate, but a distinct eye and fur character. Animals ex-

[5] Since this paper was written, a fourth allelomorph in the albino series in rabbits has been reported by Castle (Science, vol. 53, April 22, 1921, p. 387). This variation, now studied genetically for the first time, is known as "chinchilla" and differs from the wild gray or "agouti" coat color in the absence of yellow, and its replacement by white, and in the reduction of black to a slate blue.

hibiting this variation show a general quantitative reduction in the black and brown pigments in both fur and eyes. A certain amount of pigment is present in the iris but not enough to obscure the blood color of the retina. Yellow pigment is not affected. Pink-eyed animals with the "agouti" coat pattern therefore appear yellow since the black bases of the dorsal hairs are a reduced slaty or bluish tint and are covered by the fully intense yellow parts of the hair. Black animals with this variation are slaty or bluish all over in mice and a dirty near-white in rats and guinea-pigs. Its distinctness from albinism becomes evident when pink-eyed colored animals are crossed with albinos. The first generation offspring in this case are all as fully colored as the wild type and if inbred produce full colored, pink-eyed colored, and albino young.

The variation occurs in the following species:

Sciuridæ—	*Marmota monax.
Muridæ—	Mus musculus.
	Rattus norvegicus.
	*Microtus pennsylvanicus.
	*Fiber zibethicus.
Caviidæ—	Cavia cobaya.

Its occurrence in the species marked * is probable but is based only on museum specimens with the coat colors peculiar to pink-eyed animals. The eyes in the mounted specimens may or may not agree with the original.

Data on the localization of this variation are available in large numbers for mice, and in lesser amount for rats and guinea-pigs. In these species it is a simple Mendelian recessive to full color (dark-eye). In rats and mice it is certainly a homologous variation, in appearance, in inheritance and in localization, for a large amount of linkage data indicates that the genes for pink-eye and for albinism are located in the same chromosome and at about the same relative distance apart. This localizes both of these genes in both species, and leads to some interesting conclusions and speculations which will be more fully considered later. In guinea-pigs there is incomplete evidence concerning the location of the gene for pink-eye but some data which Dr. Sewall Wright has kindly extracted from his breeding records and sent to me indicate that the locus of pink-eye is not in the albino chromosome but elsewhere. As we shall see, this may prove just as instructive concerning the homologies between species in germinal constitution as the more definite localization of the gene in rats and mice.

YELLOW

The self or solid yellow coat coloration in rodents appears to be divisible as to its cause into two different categories. In the first of these may be placed those yellow varieties which have arisen by a change in a gene governing the *extension* of black and brown to the fur, and the alternative (allelomorphic) condition of *restriction* of these melanic pigments to the eye, while the pelt is yellow. In the presence of this gene (restriction [r]) the melanic pigments are probably not produced in sufficient amount or to a sufficient intensity to invade the fur, leaving the residual yellow which is present in all "agouti" animals in possession of the whole extent of the hair. This gene is recessive to full extension and is distinct in its inheritance from the gene which determines the barring of each hair in the agouti pattern. Animals may possess the gene for yellow, with the gene for "agouti" or without it. "Agouti" yellows have much lighter bellies than non-agouti yellows. Restricted yellow occurs in the following rodents:

Leporidæ— Oryctolagus cuniculus.
Muridæ— *Microtus pennsylvanicus.
Peromyscus maniculatus gambeli.
Rattus rattus.
*Rattus alexandrinus × R. rattus.
Caviidæ— Cavia cobaya.

The distinction between this yellow and the second type, about to be described, is made on grounds of the mode of inheritance only, for the appearance of the latter type is identical with that of the former. The pelt of the second type is yellow and the eyes are dark. The gene which differentiates it is however dominant over its allelomorphs agouti and non-agouti. This dominant yellow is known only in the house mouse and because of its peculiar mode of inheritance has been the subject of considerable research through a combination of genetic and embryological methods to which Castle, Little, Kirkham and others have contributed. Such investigations have established the following facts:

(1) Yellow house mice do not breed true but when bred together always produce yellow and non-yellow young in the ratio of 2:1.

(2) Litters from yellow by yellow are on the average 25 per cent smaller than litters from non-yellow varieties.

(3) In the uteri of yellow females pregnant by yellow males there have been found disintegrating embryos approaching 25 per cent of the total embryos.

Ordinary heterozygotes (hybrids in one character) when bred together produce 25 per cent pure dominants, 50 per cent heterozygotes, and 25 per cent pure recessives. In the offspring of yellow mice the two latter classes have appeared in the expected proportions; pure dominant yellows have never been disclosed by breeding tests. It has therefore been concluded that the 25 per cent missing from the litters, the 25 per cent of disintegrating embryos, and the 25 per cent of expected pure yellows are the same. The intrauterine death of this class has been supposed to be due to a recessive lethal gene which when received from both parents causes the death of the resulting zygote or individual. In every case this lethal gene has been transmitted with the gene for yellow. It may be either completely linked or identical with the gene for yellow. At any rate it is present at the same locus with the gene which determines yellow, and any individual which receives yellow from both parents receives likewise the lethal gene from both parents and is doomed to death before birth. As to why this combination of two lethal genes is fatal we are still in the dark.

This yellow gene and the lethal associated with it are known only in house mice,[6] and the restricted yellow of the other species has not been reported in house mice. They are probably not homologous variations in spite of their similarity in appearance. The "yellow" varieties of rats are not really to be classified with other yellow rodents since they are actually "agoutis", differentiated from the wild gray by the pink-eye gene (to which we have referred) or by the very similar red-eye gene which act selectively on the melanic pigments to reduce rather than restrict them.

WHITE-SPOTTING

Almost as common as albinism among rodents is the spotting of certain portions of the coat with white. The white areas are as devoid of pigment as in albinos but here the likeness ends. Genetically white-spotting and albinism are distinct and contrary to the popular belief are not quantitatively but qualitatively unlike. Albinism is fundamentally the loss or change of a factor for the development of a peroxidase essential to the production of any pigment (cf. Wright '17) and its effects are of a general nature throughout the pelt and eyes. Spotting appears to be a change in a factor governing the distribution

[6] Several other factors may modify the appearance of yellow in mice; for instance, certain darkening factors in the presence of the yellow gene produce the black-and-tan and sable varieties of mice, while intensifying factors in the presence of yellow produce the brighter orange or red varieties.

of the pigments in the pelage. When pigmentation is present all over the pelt the condition is known as self or not-spotted. Spotting is inherited independently of albinism, since certain albinos crossed with spotted animals throw only selfs, while other albinos derived from white-spotted colored stocks have given spotted offspring. An albino may therefore be genetically either self or spotted although unable to give evidence of this condition except in its offspring by a colored animal which supplies the gene for the development of color.

On the grounds of its inheritance white-spotting in rodents may be classified in three categories. The first of these is piebald or Dutch spotting, apparently due to a gene recessive to self coloration and probably independent of other coat color unit characters. It may thence be present with albinism, yellow, pink-eye, agouti or black (see below). Piebald animals may be characterized by a typical localization of the spotting in a belt or collar as in belted mice or Dutch rabbits; the spotting may be confined to the face ("white-face" mice), or it may be distributed in a fairly uniform dorsal pattern as in hooded rats.[7] On all of these types the white-spotting varies only within general limits. In other piebald mice and in guinea pigs especially it appears purely at random, in irregular blotches hardly approximating any pattern at all. The spotting may also vary in amount from a few white hairs to over half the surface of the animal, although in general the pigmented areas exceed the white portions in total size. The belly is likewise more susceptible to spotting than the dorsum. This variation has been noted many times in wild species and I am certain the present list which has been hastily compiled does not represent the true distribution of this variation among rodents in general.

Leporidæ— Oryctolagus cuniculus.
Sciuridæ— *Sciurus finlaysoni.
Muridæ— Mus musculus.
Rattus norvegicus.
*Evotomys gapperi.
Caviidæ— Cavia cobaya.

In the rabbit, rat, mouse, and guinea-pig the similarity of its inheritance points toward a homology in this variation. Data on its localization are lacking except that in mice it is probably not located in the same chromosome with albinism and pink-eye, nor with the black-eyed white-spotting about to be discussed. In rats and guinea-pigs

[7] A hooded *Microtus* has been noticed in the Museum of Comparative Zoology at Harvard University.

it is likewise not linked as far as is known with any other color variation, while in rabbits it may be a property of the same locus at which English or dominant spotting is determined.

The two other categories of spotting are peculiar each to a single species. The English broken spotting of domesticated rabbits is a Mendelian dominant to self-color and has no probable homologue in other species, while the black-eyed white-spotting of mice, likewise a dominant, is apparently peculiar to mice although wild rodents resembling this type have been reported (e.g., *Sciurus finlaysoni*). This last variety is interesting in that it is less pigmented than any other type of spotting studied, some black-eyed white-spotted mice having pigment only in the eyes, while the rest of the pelt is pure white. It is discontinuous with piebald spotting, and is, like yellow, an unfixable hybrid, always throwing, when bred pure, a ratio of two black-eyed whites to one piebald. The cause of this peculiarity has lately been traced to its association with another lethal factor which determines the death in utero of all pure black-eyed white zygotes.

BLACK

One other color variation is common enough in rodents to make comparison profitable. This is the discontinuous change from the "agouti" coat to one which is black all over and it is probably due in all the species in which it occurs to a gene determining the exclusive development of black and brown pigments. It is always present in wild "agouti" type rodents and its appearance alone is conditioned by the change producing non-agouti, or the absence of the "agouti" pattern. Its recessive allelomorph is brown, which has occurred in rabbits, mice, guinea-pigs and possibly in rats. This gene is probably not linked with any of the other known genes in mice, but its relationships in other species have not been studied. The variation from agouti to black occurs in the following species:

Leporidæ— Oryctolagus cuniculus.
*Lepus americanus virginianus—Eastern varying hare.
Sciuridæ— *Sciurus hudsonicus?
*Sciurus niger ludovicianus.
*Sciurus niger niger.
*Sciurus carolinensis leucotis.
*Tamias striatus lysteri.
Muridæ— Mus musculus.
Rattus norvegicus.
*Fiber zibethicus.
Caviidæ— Cavia cobaya.

Specimens of individuals of other species which are much darker than the wild type are often seen in museums, usually labelled "melano" or "melanic variation." Many of these should not, I believe, be assumed to represent the true black variation. Some, as in "melanic" squirrels of various species, prove on close examination to be only very much darkened "agoutis" in which the black portions of each hair have been extended at the expense of the yellow portions. This variation has been studied by Punnett in the rabbit and found to be due to a gene distinct from black which is allelomorphic with the extension-restriction pair of allelomorphs. Much darkened "agoutis" have been produced in mice by crossing intense blacks or black-and-tans (a darkened form of yellow) with wild agouti-colored mice. The darkness is due in this case to a series of modifying genes distinct from either black, "agouti" or yellow which in the presence of these genes bring about an increase in the amount and intensity of the black pigment granules and a reduction in yellow. Such extended or darkened "agoutis" can usually (though not always) be distinguished from black by the lighter belly which is typical of the "agouti" pattern.

In addition to the coat color and pattern variations discussed above, many others have occurred in rodents which have been bred in the laboratory, though they are as yet known in too few species to make comparisons profitable. One of these, dilution, is a unit character in mice and rabbits. In this variation, the pigment granules are clumped and reduced in distribution, producing when acting on black varieties the familiar maltese color of blue rabbits and mice. The maltese cat is the result of a similar variation from black. Dilution is a simple Mendelian recessive to full color. The red and black blotching of guinea-pigs, the ticking or banding of the belly hairs in guinea-pigs, and the white bellies of a fancy variety of "agouti" mice are also known to be Mendelian unit characters.[8]

SUMMARY

A summary of the preceding discussion shows that we have examined five of the commonest variations in rodents: albinism, pink-eye, yellow, white-spotting, and black. In all of these the inheritance is known for at least three species, and in general the variant is recessive to the wild type. Dominant variations have occurred often enough (such as

[8] For a fuller discussion of these the interested reader is referred to Chapter XII in Castle's "Genetics and Eugenics," 1920, and to the series of papers by Wright cited above.

"English spotting" in rabbits, and black-eyed white-spotting and yellow in mice) to make us chary about drawing any general conclusions concerning the occurrence of evolution purely by loss mutations from type. The generality that does appear is rather the widespread occurrence in this order of similar variations both under domestication when the animals are saved and bred, and in the wild, when usually only the stuffed specimens are preserved. There is implied in this similarity, which in certain cases amounts to a homology, a similarity in that part of the organism which is responsible for the variations, i.e. the germ plasm. It may be that we know in these days as little concerning the *causes* of variation as did naturalists in the days of Lamarck or of Darwin. We do at least know where the causes are to be sought, and, once having arisen by a mysterious occurrence called mutation, we have learned something of the manner in which the variations are inherited, and by a process of inference have been able to localize still more exactly the region of change. The only permissible generality, then, concerns a general similarity in the germ plasm and probably in the individual chromosomes of these many species of rodents. But in one case the similarity between species has been found to be more than general. It has been found to be quite a specific similarity.

If we examine this case in detail we find that in two distinct, intersterile species, mice and rats, two similarly appearing variations have occurred, albinism and pink-eye. In rats the genes for these variations are linked with a strength of about 21 per cent, which is possibly slightly in excess of the actual. In mice the linkage between these genes in something less than 15 per cent, which is based on observations of 6700 animals raised solely for the purpose of determining this linkage and is probably reasonably accurate. In terms of the chromosome hypothesis these facts mean that these two genes are present in the same chromosome in rats and mice, in rats at a distance of 21 units apart, in mice at a distance of about 15 units apart. The difference in location is so small that for practical purposes we can say that they are located at homologous points in the two species.

In guinea-pigs where both of these variations occur, there is incomplete evidence, but the data which Doctor Wright has supplied indicate that pink-eye and albinism in guinea-pigs are probably not linked and may therefore be determined in different chromosomes. This does not prove, however, that these variations in guinea-pigs are *not* the same as those in mice and rats. It may mean that the chromosome which contains both genes in the more primitive Muridæ may in the

more specialized Caviidæ be represented by two chromosomes, the sum of which rather than either one separately may be homologous with the one chromosome of mice and rats. Although this will be recognized as speculation, there is some slight evidence that in the evolution of the rodents a fractionation of chromosomes may have occurred, for the mice and rats have 19 (haploid) while the guinea-pigs have 28. In the rabbit (*Oryctolagus cuniculus*) a member now judged too primitive for the true rodents and recently placed in the Lagomorpha with the others of the old rodent suborder Duplicidentata, the chromosome number is probably 12. If this progressive increase in the number of chromosomes through the order Rodentia is found to be a fact and not a chance phenomenon associated with the smallness of the sample of four species from which our cytological evidence is drawn, it may furnish a very important clue to a series of evolutionary relationships of more than ordinary interest.

In the concluding chapter of his recent book Professor Morgan (1919) has referred to the possible evolutionary significance of the localization of genes as determined by the study of linkage. He has there reviewed some of the work on similar variations in several species of insects by Metz and Sturtevant, pointing out the difficulties to be encountered in applying this method to the analysis of species, chief of which is the necessity of establishing the same linear order in each species of the genes for similar variations. A species in his point of view, and in this he follows De Vries, may ultimately prove to be a "community of genes." We may expect evidence of this community in the variations which arise from time to time within the species, whether they be at the time of specific value or not. Such community is not to be inferred from mere similarity in appearance but must rest on a more real homology of germinal cause. This kind of similarity is now apparent between *Mus musculus* and *Rattus norvegicus*, which have varied so far from a common type that they are now inter-sterile and have been placed recently in different genera. Yet they have retained a genetic constitution so similar that it contains genes common to both species. Whether this is due to a community of descent in the terms of current evolutionary theory or to relationship through some other cause is one of the questions which genetics, aided by the chromosome notation, may be expected at some time to answer.

BIBLIOGRAPHY

CASTLE, W. E. 1920. Genetics and Eugenics. Harvard University Press, Cambridge, Mass.

MORGAN, T. H., STURTEVANT, A. H., MULLER, H. J., AND BRIDGES, C. B. 1915. The Mechanism of Mendelian Heredity. Henry Holt and Co., New York.

MORGAN, T. H. 1919. The Physical Basis of Heredity. J. B. Lippincott Co., Philadelphia and London.

WRIGHT, S. 1917. Color Inheritance in Mammals. Journal of Heredity, vol. 8. nos. 5–9.

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A HYBRID DEER OF THE F_2 GENERATION

BY HARTLEY H. T. JACKSON

[*Plate 8*]

INTRODUCTION

Among deer hunters who search for their spoils on the eastern slopes of the Cascade Mountains in the state of Washington, it is quite generally known that in a certain region the mule deer (*Odocoileus hemionus hemionus*) and the Columbian black-tailed deer (*Odocoileus columbianus columbianus*) hybridize. This area is where the western range of of the mule deer and the eastern range of the black-tail overlap. It may be roughly outlined by the summit of the Cascade Mountains on the west; the region of Stampede (or Yakima) Pass and lakes Keeches and Keechelus on the north; a line drawn north and south through a point 6 miles east of Signal Peak, the Tieton Basin, and Frost Mountain on the east; and Mount Adams on the south. Mr. James Henderson writes:

> This cross breeding of the mule deer and the Columbia black-tailed deer is not common. . . . . The different varieties of deer have their respective ranges very well defined, the mule deer seldom going to the summit of the divide and never, to my knowledge, beyond on the west slope. They are very much more scarce than the black-tails near the summit. I believe the lack of mates of their own kind leads the bucks of this variety to cross with the does of the black-tailed kind. Their offspring will then mate with either. (Letter to the U. S. Biological Survey from James Henderson, Mabton, Washington, April 24, 1917.)

Very few of these hybrids have found their way into mammal collections and, their direct lineage being unknown, any of them collected in their native habitat would have little, if any, scientific value, in so far as studies in heredity are concerned. In March, 1917, the United States Biological Survey received a hybrid deer from Mr. A. S. Hormer, North Yakima, Washington, which had been raised in captivity by Mr. James Henderson. This specimen, a tanned skin accompanied by imperfect skull, is now numbered 223,685, United States National Museum, Biological Survey Collection. In regard to this animal Mr. Henderson writes:

> This deer was killed in January, 1915, and would have been 4 years old the following May. It was rather a tall rangy deer of good proportions and fairly large bones. It was born and raised in my enclosure and was killed on account of becoming so vicious as to be very dangerous. I procured his grandsire from Ellensburg, Washington, on the east slope of the Cascade Mountains. He was a fine specimen of mule deer, full blood. The granddame was secured near South Bend on Willapa Harbor on the coast of this state. She was a full blood Columbia black-tail. These two deer mated and produced a pair of female fawns. About the same time I procured a full blood mule doe from the same man who furnished me the mule buck, Mr. Chris Gray, of Ellensburg, Washington, now deceased. This doe was with fawn to a full blood Columbia black-tail buck owned by Mr. Gray. This mule doe gave birth to a pair of male fawns after she came into my possession and at about the same time as the other pair was born. I selected a female from one pair and a male from the other pair of fawns and raised them until they bred and raised the deer of which you now have the skin and head.
>
> . . . . There are quite a few [hybrids] on the east slope of the Cascade Mountains, where a few full blood mule deer live, going down on the east side in winter, while the Columbia black-tail go down the west slope to winter. Owing to the small numbers of mule deer they sometimes cross breed in their wild state and readily cross in domestication when dependent on man for existence. (Letter to U. S. Biological Survey from James Henderson, Mabton, Washington, March 29, 1917.)

COMPARISON OF THE HYBRID WITH ITS PARENT SPECIES

The ancestry of this animal (H^2) is represented graphically in figure 1. Unfortunately none of the parents or grandparents of the specimen is available and all that can be attempted in the present paper is to compare it briefly with each of its parent species. The mule deer differs in external characteristics from the black-tail in that it is a larger animal; the ears are relatively longer, and larger in general; the hair on all surfaces of the tail for the proximal $\frac{2}{3}$ to $\frac{3}{4}$ of its length is white or whitish, whereas in the black-tail the upper surface of the tail is covered

with black or blackish hairs the entire length; the metatarsal gland is longer in the mule deer; the antlers are larger in all proportions, with the primary divisions of the beam forking at a lesser angle, the anterior fork extending more nearly vertically to the plane of the occiput (less forward and inward). Cranially the mule deer differs from the black-tail in that the post-frontal region arises distinctly

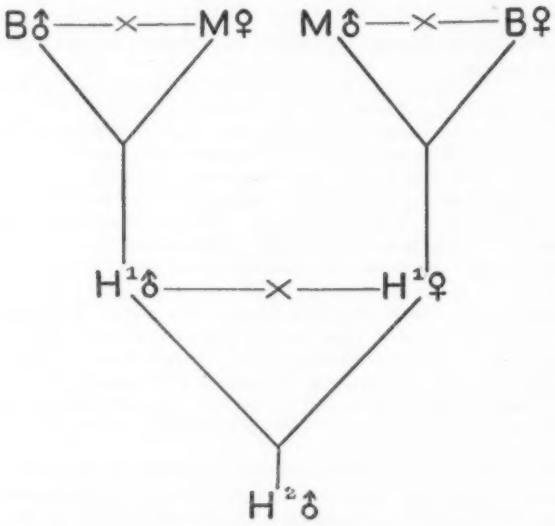

FIG. 1. DIAGRAMMATIC REPRESENTATION of ANCESTRY OF SPECIMEN NUMBER 223,685, U. S. NATIONAL MUSEUM, BIOLOGICAL SURVEY COLLECTION

B, Columbian black-tailed deer; *M*, mule deer; H^1, hybrid from first cross; H^2 (specimen 223,685), hybrid from second cross; ♂, male; ♀, female; ×, crossed with.

higher and more abruptly, producing in effect a more depressed interorbital region, whereas in the black-tail the superior aspect of the skull is comparatively flattened. There are other *average* differences between the two species, but in fully adult animals of comparable age the two forms seem to be sharply differentiated in each of the above characters, there being no overlapping, nor intermediates, in the numerous specimens examined.

SKULLS OF DEER

FIG. 1. *Odocoileus columbianus columbianus.* Number 8154, U. S. Nat. Mus. Puget Sound, Washington.

FIG. 2. *Odocoileus columbianus columbianus* × *Odocoileus hemionus hemionus.* Number 223,685, U. S. Nat. Mus., Biological Survey Coll. Mabton, Washington.

FIG. 3. *Odocoileus hemionus hemionus.* Number 230,960, U. S. Nat. Mus., Biological Survey Coll. Winthrop, Washington.

UNIV. OF MICH.

The hybrid specimen is not strictly intermediate in characters between *hemionus* and *columbianus*. In some characters it is indistinguishable from *hemionus*, in another like typical *columbianus*, and in one respect it appears to be intermediate. On the whole it is more like *hemionus* than like *columbianus*. The hybrid was a large deer and, in size, would pass for a rather large *hemionus*. It also has the large ears characteristic of the mule deer. The metatarsal gland on the left leg measures, in the tanned skin, 125 mm., that on the right leg 119 mm., in every respect typical glands of full blood *hemionus*. The antlers also are indistinguishable from those of the mule deer. They are not as long as some mule deer antlers, but have as heavy beams as any I have examined, and branch in a fairly normal mule-deer fashion. The tail, however, is distinctly and unmistakably like that of a black-tailed deer. The post-frontal region of the skull appears to be intermediate between that of a black-tailed deer and that of a mule deer, but probably is nearer that of the black-tail. Viewed in life then, this animal undoubtedly had the appearance of a mule deer with a black-tailed deer's tail.

CONCLUSIONS

It is to be admitted that from a geneticist's point of view this paper is not entirely satisfactory and that a more serious study of the specimen might bring out many additional facts. However, three points are worthy of notice. Regardless of variance of opinions as to the definitions of a species and a subspecies, so far as I am aware it has been conceded by all mammalogists that the mule deer and the black-tailed deer are distinct species. The first point, then, is that within a certain area in the state of Washington *two distinct species*, the mule deer and the black-tailed deer, *interbreed in their native habitat*. Second, the *hybrids of the first filial generation* produced by the crossing *of these two distinct species are fertile to each other*. Third, it is strongly *suggested that in these crosses certain unit characters are transmitted to the offspring*. The hybrid studied was essentially a mule deer in several characters, black-tailed deer in at least one character, and showed a possible tendency to be intermediate in one. Whether these characters are transmitted in Mendelian ratio is, of course, impossible to determine with the material at hand.

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FOSSIL CETACEANS FROM THE FLORIDA PHOSPHATE BEDS

By Glover M. Allen

[*Plates 9–12*]

The occurrence of fossil cetaceans in Florida was briefly made known by Leidy, who, in 1889, recorded "half a dozen vertebræ and several teeth of several Cetacea of the family of the Dolphins" from the Peace Creek deposits. Concerning these remains, however, he makes no comment beyond the fact that they were "undetermined." More recently, in the commercial development of the phosphate beds, particularly in Polk County, additional fragments have come to light. Three of these are figured with brief mention, by Sellards (1915, p. 102–105) in the Seventh Annual Report of the Florida Geological Survey, but no attempt has been made to identify the species which they represent. Through the kind offices of Mr. Anton Schneider, lately Superintendent of the Amalgamated Phosphate Company, and through the interest of Vice-President F. F. Ward of the International Agricultural Corporation with works at Mulberry, the Museum of Comparative Zoölogy has recently acquired a few additional remains of fossil Cetacea from Polk County, and these, together with several fragments generously loaned by the Florida Geological Survey, form the basis of this paper.

GEOLOGICAL OCCURRENCE

All the specimens come from what are known as the "land-pebble phosphate deposits," which, according to current geological opinion (Sellards, 1915, p. 58) constitute a pebble conglomerate, accumulated under marine or estuarine conditions, probably during late Miocene or early Pliocene time. This conglomerate forms the basal member of the "Bone-Valley formation," and is derived chiefly from an older phosphatic marl of Upper Oligocene age, from which have probably been redeposited the teeth of sharks and rays, casts of invertebrates, and silicified corals that occur with the broken but unworn bones of later-deposited cetaceans and crocodilians. It is believed that this area was exposed as a land surface during most, if not all of the Miocene, at the close of which it was again submerged, thereby allowing the accumulation of the conglomerate together with the remains of aquatic vertebrates of the period, in what must have been a relatively shallow sea.

The cetacean remains consist of fragments of the skull or vertebræ, and though for the most part badly broken, seem to have suffered as much from rough handling during extraction as from actual erosion, since they are chiefly such pieces as chanced to have been rescued in the course of mining the phosphate. Exact data as to the original relations of the specimens in the deposit are therefore unobtainable.

SPECIES REPRESENTED

At least three species of cetaceans, pertaining to as many genera, are represented by the material in hand. Two of these are dolphins of the slender-beaked type common in Miocene deposits of Europe, and related to the existing Iniidæ of estuarine and fluviatile habitat. Of these, one seems referable to the genus *Schizodelphis*, first recognized as occurring in America by True (1908); the other is a related genus for which a new name is proposed. It is peculiar in that the lower tooth rows close, proximally at least, *within* the upper, instead of interlocking. What seems to be a species of the same genus is present as well in Miocene formations of Europe, though the Florida species is more progessive than the European, and appears to represent the culmination of its line of evolution. The third species falls in the Physeteridæ or sperm-whale family. It is a whale of medium size, apparently congeneric with a species—*Diaphorocetus poucheti*—described from the Miocene of Patagonia. Like that species, it differs from existing members of this family through the possession of a rostrum rather narrow basally and provided with fully functional teeth in the upper as well as in the lower jaw.

An account of these fragments follows.

INIIDÆ—River dolphins

Schizodelphis depressus sp. nov.

Plate 9, fig. 1–5

1869. ? *Priscodelphinus grandaevus* Leidy, Journ. Acad. Nat. Sci., Phila., ser. 2, vol. 7, p. 434 (in part).

1904. ? *Rhabdosteus latiradix* Case, Md. Geol. Surv., Miocene, p. 24 (in part), pl. 15, fig. 1 (not of Cope).

1908. ? *Priscodelphinus sp.?* True, Proc. Acad. Nat. Sci., Phila., p. 28, fig. 1–3.

Type.—A fragment of the beak, 828 Fla. Geol. Surv., about 283 mm. in length, broken off in advance of the vomer; found five miles south of Bartow, Florida.

General characters.—A long-beaked dolphin of the *Schizodelphis* type, but

differing conspicuously from *S. sulcatus* in the flattening of the rostrum anteriorly and from *S. crassangulum* in the wider spacing and apparently greater size of the teeth. A shallow, broadly V-shaped groove occupies the midline of the palate and gradually fades out toward the tip of the beak. From the edge of this groove the plane of the maxilla slopes gently upward and outward to the strongly rounded lateral border, but near the tip of the beak the palate becomes nearly flat. The alveoli are large, the more proximal the smaller and separated by an interval less than the length of a single alveolus. The more anterior sockets are larger and farther apart, being separated by an interval nearly 1½ the length of a single alveolus. The alveoli themselves are nearly oval in outline, the more proximal directed slightly outward and forward, but the more distal with their long axes nearly parallel to the tooth rows.

Description.—This species is represented in the collection of the Florida Geological Survey by two fragments of the rostrum. The larger, here made the type of the species, is a section broken from slightly in advance of the palatal portion of the vomer. Its length is 283 mm., its breadth at base 48 mm., tapering to 37 mm. wide at the broken distal end. Its left basal end just includes the beginning of the deep longitudinal groove separating maxillary and intermaxillary. The combined intermaxillaries are at this point high (13 mm. above the groove) and broad (32 mm.) but become depressed and flattened forward, though losing little of their width. Though the right intermaxillary is very slightly the narrower, there is no marked asymmetry.

The large alveoli are nearly oval in outline and shallow. The first six or seven at the proximal end of the fragment are smaller and closer together than those succeeding and have their long axes turned slightly outward. The proximal four of the right side are smaller and closer together than those corresponding on the left side, and are included within a space of 31 mm. The separate alveoli average 6 by 3.5 mm., and are about 2 mm. apart. Beyond this point they are larger and of nearly uniform size, about 7.5 by 4.5. mm., elliptical in outline with their long axes parallel to the tooth row. The interspaces gradually increase to about 10 mm. at the anterior end of the fragment.

The second specimen (5885 Fla. Geol. Surv.) referred to this species, came from much nearer the tip of the beak. It is 172 mm. long, 28 mm. wide at the proximal and 25 mm. wide at the distal end. Its dorsal portion is largely formed by the intermaxillæ, which are nearly flat above, and have fused medially so that no trace of the original suture is evident. The combined width of the intermaxillæ is 18 mm. proximally and 13.5 mm. distally. This portion of the beak is strongly flattened dorsoventrally so that the palatal surface is nearly parallel to that of the intermaxillaries. Laterally, however, the maxillaries are slightly bevelled outward from the palate, and the tooth sockets are situated along this narrow bevelled area so that they are visible in side view. The comparatively large size, nearly elliptical outline, and wide spacing of these shallow sockets are maintained very uniformly to the anterior end of the specimen, which must have included all but a very small portion of the tip of the beak. The groove marking the line between maxillaries and intermaxillaries becomes much shallower on the right-hand side than on the left, though in the larger fragment this disparity was not noticeable.

Possibly referable to this species is the centrum of a lumbar vertebra (15786 M.C.Z.) from Mulberry. It has lost the lateral processes and the neural spine, but shows, still intact, a median dorsal ridge running nearly the entire length of the vertebra. This is low and laterally compressed, with rounded summit, and about 4 mm. high at the middle point, where on each side are one or two small pits in the groove at its base. Dal Piaz (1905) mentions a similar ridge on the vertebræ of *Schizodelphis sulcatus* and it is visible in anterior view in several of the vertebræ he figures. The centrum itself is long as compared with that of most modern dolphins, some 57 mm., lacking the posterior epiphysis. The anterior face is subcircular in outline, with a vertical diameter of 32 mm., and has a small linear depression at its center. The posterior outline is subtriangular due to the flattening of the ventral contour.

Remarks.—Of these three specimens, the larger rostral fragment recalls very strongly a similar piece from the Miocene of Shiloh, New Jersey, referred by Leidy (1869) to his *Priscodelphinus grandaevus* and figured as such by Case (1904, pl. 15, fig. 1), and again as *Priscodelphinus sp.*? by True (1908 a, p. 28, fig. 1–3). Indeed, the Florida specimen seems to offer little in itself to distinguish it from the New Jersey fragment, except that its intermaxillæ in side view are possibly higher in proportion to the maxillaries. All the fragments may therefore be provisionally considered as representing the same species. The selection of a name for them, however, is not an easy matter. For, though Leidy referred the Shiloh specimen to his *Priscodelphinus grandaevus*, the latter was really based on two caudal vertebræ of an immature animal, so that the association of the rostral fragment with these is purely assumptive, though all the bones were from the same locality. Furthermore, it is uncertain whether the caudal vertebræ on which the species *grandaevus* was founded, are congeneric with the dorsal vertebra which Leidy made the type of the genus *Priscodelphinus*. Moreover, there appears to be some ground for believing (True, 1908) that this genus is itself identical with *Schizodelphis*. If this identity could be shown through the discovery of an associated skeleton, the former name would have priority, and the latter would then become a synonym of it. But awaiting further light on the matter it seems best to retain the two generic names as originally applied. True (1908 a) in referring again to Leidy's specimen refrains from giving it a specific name, but the occurrence of what seems to be the same dolphin in the Florida deposits makes it advisable to give it a distinctive title for convenient use, even though the fragments at hand are insufficient for a complete diagnosis.

Pomatodelphis gen. nov.

Diagnosis.—Long-beaked dolphins resembling *Schizodelphis* in general form of the skull except that the rostrum has a convex expansion of the maxillary outline at the proximal end of the tooth rows; combined width of lower jaws narrower than the upper so that the lower tooth rows close *inside* the upper (like the lid of a pot—πῶμα); teeth of lower jaw directed upward into the maxillary, where the tips of the more posterior are received in shallow pits, instead of being, as in *Schizodelphis*, directed outward and interlocking with the maxillary teeth outside the tooth rows.

Genotype.—*Pomatodelphis inaequalis* sp. nov.

Pomatodelphis inaequalis sp. nov.

Plates 10, 11

Type.—A fragment, 15750 M.C.Z., from the base of the right maxilla, 114 mm. long, comprising one-half the breadth of the palate, from Brewster, Polk County, Florida. Gift of Amalgamated Phosphate Co., through Anton Schneider and Thomas Barbour.

Description.—The type fragment includes thirteen small and much compressed alveoli, of which the posteriormost are close together but the more anterior are much farther apart. All are round-edged and contract forward to a point; they are mere slits and probably did not support functional teeth. Internal and parallel to this row of thirteen alveoli is a series of some ten or eleven shallow pits made by the tips of the mandibular teeth, which closed perpendicularly against the maxilla inside the line of the upper tooth row. The palate itself is quite flat. The external border of the maxilla is abruptly and strongly rounded.

Three specimens in the collection of the Florida Geological Survey supplement the type most acceptably. They comprise a cranium, which though in several fragments wants little more than the terminal part of the beak and the middle portion of the brain case; a second imperfect rostrum, comprising most of the base of the beak; and a third fragment from near the tip of another rostrum. From these a fairly clear idea of the cranium may be gained.

The summit of the cranium instead of culminating in the elevated nasals, as in modern Delphinidæ, is formed by a transverse crest along the line of union of the frontals and the supraoccipital. The latter seems to have been nearly perpendicular to the long axis of the cranium, so that the back of the skull is rather squarely truncate. The interparietal appears medially at the apex of the skull, as a narrow transverse bone wedged in between the large supraoccipital and the frontals. It is about 40 mm. from side to side and 6 mm. in antero-posterior extent in the midline, tapering to a point at each side. In front of it appears a slightly depressed rectangular field formed by the frontals, some 25 mm. square against the anterior side of which abut the remains of the nasals.

The blowholes are embraced by the proximal ascending portions of the intermaxillæ, the tips of which are here contracted to a blunt point in contact with the middle of the frontal on either side, some 10 mm. in advance of the transverse occipito-frontal ridge. A large foramen opens under the posterior margin of

each intermaxillary. It is continued forward and inward beneath this bone and is probably the opening of a perforation of the maxillary quite obvious in most modern dolphins, but here covered by the expanded intermaxillary. The backward extension of the maxillary almost completely covers the outer part of the frontal, at least on the right-hand side, and thus heightens the appearance of fore-and-aft compression of the brain case.

The intermaxillaries are broad, thin and nearly plane posteriorly, but quickly become narrower opposite the front of the blowholes, and then slightly expand, their surfaces sloping inward toward the triangular area in front of the nares, before continuing forward on to the beak. A very shallow groove runs from near the outermost part of this proximal expansion, forward and inward, becoming lost at the inner sloping margin of the triangular area. A similar groove is present in *Schizodelphis*. At this level commences a marked asymmetry. The right intermaxillary suddenly narrows while the left broadens out for a short distance and becomes much thinner at its outer edge. Forward from this point both intermaxillaries become raised and thickened, extending as two parallel flat-topped ridges, closely appressed medially, to the broken extremity of the beak. From the flattened maxillaries they are sharply marked off by a deep longitudinal groove along the line of contact. The right intermaxillary is markedly the smaller and its delimiting groove the shallower.

A fragment (2343 Fla. Geol. Surv.) from very near the tip of a rostrum, and apparently representing the same species, shows that the two intermaxillaries fuse medially toward their distal extremity.

The base of the rostrum is peculiar in outline. Opposite the anterior tips of the pterygoids it becomes strongly compressed from side to side, with gently concave margins as seen from below; then it expands widely, reaching the greatest convexity opposite the base of the visible part of the vomer, beyond which it tapers forward to form the beak. The tooth rows begin just in advance of the widest expansion. There is thus a distinct neck formed at the base of the rostrum succeeded by a convex expansion, very different from the gradual and even taper from the maxillary notches forward, seen in *Schizodelphis*. A somewhat similar outline is seen, however, in the newly discovered living genus, *Lipotes* (Miller, 1918). In ventral aspect, the entire palate in advance of the vomer is quite flat with a shallow median V-shaped groove where the bevelled edges of the maxillaries meet. It thus differs markedly from *Schizodelphis sulcatus*, in which according to the figures of Dal Piaz (1903, p. 195) the maxillaries are strongly bevelled outward. At the base of the rostrum the pronounced asymmetry previously noted in the dorsal aspect is again evident. For while on the left-hand side of the beak the proximal part of the maxilla widely expands, carrying with it the tooth row, on the right-hand side the expansion is less marked, and the palatal surface is much more nearly in a vertical plane so that the tooth row is placed much higher on the cheek. The alveoli are also smaller and closer together on the right-hand side in this region.

The vomer appears in advance of the palatals as a narrow lozenge-shaped slip about 100 mm. long by 8 wide in the broadest place. Fortunately enough remains of the posterior end of the vomer to fix the shape and position of the blowholes. That of the right-hand side is much the smaller and opens well to the right of the median axis of the skull, while that of the left side is so much larger

and has so encroached on its neighbor that it has come to occupy a median position. This asymmetry seems not to be found in *Schizodelphis* (the apparent asymmetry shown in Dal Piaz's figures, 1903, pl. 1, is obviously due to distortion of the fossil). Although an accurate measurement is not possible, the left blowhole seems to have been at least 20 mm. in antero-posterior diameter, the right-hand blowhole about 14 mm.

The alveoli of the upper jaw, particularly those of the right-hand side, are more or less slit-like, rounded posteriorly and contracted to a point forward. Their edges instead of being sharply defined, are rounded, with a healed-over appearance, and it seems probable that if teeth were present at all in the upper jaw they must have been very small, non-functional, and with bases buried in the gums instead of fitting into sockets. The posterior alveoli of the left side are apparently a little larger at the base of the rostrum and may have held small teeth.

Most remarkable is the series of depressions seen on the palate *internal* to each tooth row, in at least the basal portion of the beak. These are obviously made by the tips of the *mandibular* teeth, and may or may not come opposite the alveoli of the upper jaw. Their presence indicates that the teeth of the mandible closed vertically *into the maxilla*, that they were larger than the maxillary teeth if any existed, and that the width across the lower tooth rows was less than that across the upper alveolar series. This allowed the upper jaw to close over the lower jaw like the lid of a pot. A certain parallelism may be seen here with the sperm whale, in which the lower jaws are in like manner narrower than the width between the upper alveolar lines, the rostrum has at the same time become expanded, and the upper teeth have become functionless. No doubt this modification is a result of a change from an actively fish-capturing habit to one requiring less seizing and holding as in the squid-eating (teuthophagous) cetaceans generally.

In the fragment, from the right side near the base of the rostrum, there are 6 alveoli in a space of 33 mm., with intervals of from 2 to 8 or 9 mm. between them, and 6 depressions formed by the mandibular teeth in a space of 55 mm. In the larger rostral fragment (5834 Fla. Geol. Surv.) there are:

Right side	6 alveoli in 32 mm. near base
	6 alveoli in 56 mm. near end
	6 depressions in 50 mm. about halfway
Left side	6 alveoli in 53 mm. near base
	6 alveoli in 68 mm. about halfway
	6 depressions in 69 mm. about halfway

In the small fragment from the tip of the beak (2343 Fla. Geol. Surv.) there appear to be 6 aleovli in about 35 mm.

The posterior end of the cranium (5834 Fla. Geol. Surv.) which has served for the greater part of the above description, is considerably broken, but enough fragments remain to afford a good idea of its appearance. The condyles are large and prominent yet quite without the distinct neck shown in skulls of *Schizodelphis sulcatus* (Abel, 1899; Dal Piaz, 1903). That of the right side is the larger. The lack of a distinct neck to the cranial condyles and their large smooth surface tending to merge with that of the occiput show a progressive condition considerably ahead of the latter genus. The greater fore-and-aft compression is further shown by the notably shorter distance both relatively and absolutely between

the glenoid cavity of the jaw and the cranial condyles. The occipital crests arise as sharp ridges from the upper side of the squamosal processes, and meet in a transverse ridge at the summit of the skull. Posteriorly the squamosal and adjacent surfaces are irregularly pitted or roughened for muscle attachments, quite unlike the smooth surfaces in skulls of modern dolphins. The glenoid cavity for the articulation of the jaw is relatively small, a primitive feature, and that of the right side is the smaller. A broad groove bounds the lower inner margin of the articulating surface.

The specimen affords the following complete measurements:

	mm.
Extreme width of skull across squamosal processes	199.0
Width of braincase across bases of same	143.0
Width across occipital condyles	91.5
Right condyle, greatest vertical diameter	52.0
Right condyle, greatest transverse diameter	32.0
Left condyle, greatest vertical diameter	49.0
Left condyle, greatest transverse diameter	30.5
Foramen magnum, greatest vertical diameter	27.0
Foramen magnum, greatest transverse diameter	40.0
Lip of foramen magnum to basisphenoid suture	81.0

Remarks.—In establishing this new genus and species a careful review of the literature has been made in order to ascertain if other specimens, congeneric with it, have been described. It is obvious that species and genera based on other parts of the skeleton than the cranium can at present afford no sure points of comparison. There are, however, two specimens from the Miocene of Europe, that appear to be referable to the new genus. The first of these is a fragment of the right maxilla first mentioned and figured by Cuvier (Rech. sur les Oss. Foss., 1823, ed. 2, vol. 5, pt. 1, p. 317, pl. 23, fig. 38) as belonging to a "dauphin dont une portion de mâchoire supérieure a été trouvée dans le calcaire grossier du département de l'Orne." In the fourth edition of the same work (1836) the specimen is said to be from the "département de Maine-et-Loire." Whichever locality may be correct, it is fairly certain that the horizon is Miocene, probably middle Miocene. The specimen is next referred to by Holl (1829) in a work rarely cited, Handbuch der Petrefactenkunde. Here it is listed as "*Delphinus stenorhynchus* Cuv." with brief mention and reference to Cuvier's work. The latter author, however, though having observed in his original account, that the species was unlike any other hitherto described, gave it no name either in this or in the later editions of the Ossemens Fossiles, and apparently quite overlooked or ignored Holl's name. Thus Holl, though citing Cuvier as authority, seems to have been himself the actual author. Later writers, including Brandt,

have attributed the name to Keferstein (1834), who, however, cites it without reference as a synonym of *D. longirostris*, a name applied to a living species of *Prodelphinus* by Gray in 1828, and to a species of *Delphinus* by Dussumier in 1829. In 1846, Laurillard, evidently supposing that the fossil required a new specific designation formally bestowed the name *Delphinus renovi* upon it after the original discoverer, and it is so figured in three views by Van Beneden and Gervais in the Ostéographie. Finally, Longhi in 1898, referred it to the genus *Champsodelphis*. As may be gathered from the figure (Text-fig. 1), it agrees with the Florida species in the strongly convex outline of the base of the maxilla. In both, the proximal end of the tooth row makes

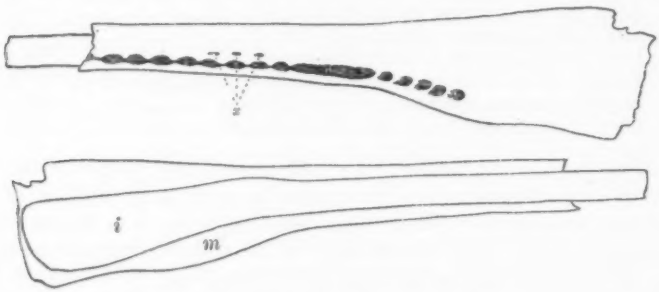

FIG. 1. *Pomatodelphis stenorhynchus* (HOLL)

Dorsal (lower fig.) and ventral (upper fig.) outlines of the type specimen. France, Département de l'Orne. After Van Beneden and Gervais, Ostéographie, pl. 57, fig. 9. *i*, intermaxillary; *m*, maxillary; *x*, depressions for reception of mandibular teeth.

an outward bend at this point, but in the French specimen the row of alveoli ends about opposite the summit of the convexity, whereas in the Florida species it ends in advance of this point. Moreover, the alveoli themselves seem much larger in the former and doubtless supported functional teeth. A more important point is indicated in the figure by the presence of three shallow depressions near the middle of the length, internal to the alveolar row, for the reception of the points of the corresponding mandibular teeth. This detail, perhaps not fully brought out by the artist, shows that the lower tooth row closed *within* the upper, at least proximally, and, taken in connection with the similarity of the maxillary outline, seems to indicate at least a generic affinity with *Pomatodelphis*.

It seems almost certain that Paquier's *Schizodelphis depereti* is the same species as that represented by Cuvier's fragment. The type specimen comprises the cranium forward of the blowholes and most of the lower jaw, but the rostrum has been broken off somewhere near its middle. The excellent photographs of the specimen show the same convexity at the base of the maxillary, while the broken and projecting end of the lower jaw is obviously much narrower than the upper at the same point, as if it had closed *inside* the latter, a point further indicated by the fact that the small lower tooth preserved is expressly stated to have its tip hidden in the upper maxillary. In both dorsal and ventral views, the right and the left sides show no marked asymmetry. Abel (1899) though admitting many discrepancies between this skull and that of *Schizodelphis sulcatus*, nevertheless dismisses it as representing probably the latter species. The locality of Paquier's specimen is southern France, "les carrières de Chamaret (Drôme)" in the Rhone valley. The formation is the "mollasse burdigalienne," considered to be lower Miocene. Assuming that Paquier's specimen represents the same species as Cuvier's from northern France, the synonymy will stand as follows:

Pomatodelphis stenorhynchus (Holl)

1823. Dauphin . . . . du département de l'Orne, G. Cuvier, Rech. sur les Ossemens fossiles, ed. 2, vol. 5, pt. 1, p. 317, pl. 23, fig. 38 (see ed. 5, 1836, p. 168, pl. 224).
1829. *Delphinus stenorhynchus* Holl, Handbuch d. Petrefactenkunde, part 1, p. 70.
1834. *Delphinus longirostris* oder *stenorhynchus* Keferstein, Die Naturgeschichte des Erdkörpers, vol. 2, p. 203 (not *D. longirostris* Gray, 1828; not Dussumier, 1829).
1841. *Delphinus longirostris* H. von Meyer, Neues Jahrb. f. Mineral., 1841, p. 327.
1844. *Delphinus renovi* Laurillard, in D'Orbigny, Dict. Univ. d'Hist. Nat., vol. 4, p. 634, pl. fig. 38.
1873. *Delphinus renui* Brandt, Mém. Acad. Imp. Sci. St. Pétersbourg, ser. 7, vol. 20, p. 247 (*emendatio*).
1894. *Schizodelphis depereti* Paquier, Mém. Soc. Géol. de France, vol. 4, no. 12, p. 7.
1898. *Champsodelphis renovi* Longhi, Atti Soc. Veneto-Trent. Sci. Nat., Padova, ser. 2, vol. 3, p. 333.

Though referred to the same genus, there seem ample grounds for considering the French species distinct from the Florida one. The figures of the former, especially that of Cuvier representing the right maxillary, show the proximal alveoli large and somewhat closely

crowded, instead of small and well spaced. The intermaxillaries in profile do not curve upward so abruptly, their outline as seen from above is different, and there is no such marked asymmetry as shown in *P. inaequalis*. The latter in its greater specialization seems to be a more progressive species, as might perhaps be anticipated from its supposedly later geologic appearance (upper Miocene or lower Pliocene).

The peculiar vertical implantation of the mandibular teeth, and the fact that at least the more proximal close within the maxillary rows, suggest a possible relationship to *Platanista*, in which exactly these conditions occur at the base of the beak, although in other respects the latter genus shows far greater specialization, as in the greater compression from side to side, of the entire rostrum. The development of its characteristic maxillary crests seems of less systematic importance, for incipient crests are found in *Phocæna* on the intermaxillaries, and very large ones in *Hyperoodon* on the maxillary bones.

PHYSETERIDÆ—Sperm whales

Diaphorocetus mediatlanticus (Cope)

Plate 9, fig. 6; Plate 12

1895. *Paracetus mediatlanticus* Cope, Proc. Amer. Phil. Soc., vol. 34, p. 135.
1902. *Hypocetus mediatlanticus* Hay, Bull. U. S. Geol. Surv., no 179, p. 596; Case, Md. Geol. Surv., Miocene, 1904, p. 30, pl. 17, figs. 6a, 6b.
1904. *Hypocetus atlanticus* Case, Md. Geol. Surv., Miocene, expl. of plates, p. 9 (*errorim*).
1898. *Diaphorocetus mediatlanticus* Trouessart, Cat. Mamm., new. ed., p. 1053; 3d ed., 1905, p. 772.

To this genus and species are referred a fragment of the lower jaw, including both rami, from the phosphate beds at Brewster, Polk County, and a second fragment comprising the occipital condyles, from Mulberry. Apparently pertaining to the same species is the beautiful specimen figured by Sellards (1915, p. 103, fig. 32), also found at Mulberry, consisting of the basal portion of the rostrum including both upper and lower jaws. Most unfortunately, this piece, which was for a time in the possession of the International Agricultural Corporation, has been disposed of and cannot be traced.

The genus *Hypocetus* was established by Lydekker in 1893, as a substitute for *Mesocetus* (preoccupied) of Moreno (1892), type *Mesocetus poucheti*, a medium-sized cetacean of the sperm-whale family,

with well developed, functional teeth in the upper as well as in the lower jaw. On a subsequent page of the same paper, Lydekker, evidently through inadvertence, calls the genus *Paracetus*, but *Hypocetus* has page priority. This paper, though bearing date 1893, was actually issued in April, 1894, and is, therefore, later than a paper by Ameghino dated February, 1894, in which the generic term *Diaphorocetus* is proposed for the same specimen and thus has priority (see Palmer, Index Gen. Mamm., 1904, p. 341). A further difficulty in the specific reference lies in the fact that it is not clear whether Cope's species *mediatlanticus* really differs from Moreno's *poucheti*. The type of the latter is a fairly well preserved skull lacking the jaw, from Bahia Nueva, Chubut Territory, Patagonia, found in a formation which Ameghino believed to be of Eocene age, but which is now considered to be lower Miocene (True, 1910, p. 31). Cope's type of *mediatlanticus* is a large fragment consisting of the base of the rostrum with the alveoli of the proximal seven or eight pairs of maxillary teeth, and parts of the intermaxillaries, vomer, and adjacent bones. It is from the St. Mary's formation at Drum Point, Maryland, now regarded (Cushman, 1920, table opp. p. 40) as of upper Miocene age. Cope attempts no comparison of his specimen with Moreno's *poucheti*, beyond the statement that the two are "not distantly related." From Case's figure of the type, however, it appears that the alveolar row extended back only to the level of the middle of the vomer, whereas, in Moreno's figure (1892, pl. 10) of *poucheti*, indications of alveoli seem to continue considerably posterior to the vomer. A slight difference in the outlines of the palatal bones is also seen, but how far these differences are individual rather than specific must await the discovery of additional specimens. It therefore seems best to retain Cope's name *mediatlanticus* for the present and to refer the Florida fragments provisionally to it. A description of these follows.

(1) The finest specimen of all is the fragment of rostrum figured by Sellards (1915, p. 103, fig. 32), as the "side view of upper and lower jaw of another cetacean." It is shown at about one-half natural size and was 300 mm. long, comprising a portion of both jaws broken from slightly in advance of the symphysis. It obviously includes some of the posteriormost of the teeth. Its upper profile is nearly plane with a line parallel to it marking the suture between maxillary and intermaxillary. The ventral outline of the lower jaw shows the distinct angle at the beginning of the symphysis so characteristic of the sperm whales. Posteriorly from this angle the teeth of both jaws at once show a successive diminution in size, while in advance of it they are all of a nearly uniform size and

spacing. The opposing series of the two jaws interlock, with the points of the teeth directed outward, those of the more posterior slightly recurved. A longitudinal crack appears in the mandible, evidently due to crushing. The photograph shows very clearly that the teeth had distinct crowns, doubtless of enamel, which stand out dark and discolored in contrast to the white of the exposed roots. Eleven maxillary teeth are apparent in the figure and at least ten mandibular teeth (Plate 12, fig. 13).

(2) The second fragment is from Brewster, Polk County (15751 M.C.Z.), the gift of Dr. Thomas Barbour. It is a section, some 150 mm. long, of the conjoined mandibles beginning slightly in advance of the symphysis. At the posterior end the rami are separate for about 20 mm.; in front of this point they begin to contract slightly in width and are thoroughly fused together with the line of contact deeply impressed. Three complete alveoli with parts of two others are present in each ramus. The posteriormost on the right side is the smallest. It contains a root still in place and is separated by a narrow interval from the alveolus next in advance. The three succeeding alveoli are about of the same size with interspaces greater than those separating the alveoli of the left side. From this it results that the corresponding sockets of opposite sides are not in the same transverse plane, but alternate with the opposite interspaces. The lengths of these sockets and interspaces are:

	Left ramus	*Right ramus*
Proximal socket	—	18
First interspace	10	2
Second socket	22.5	20
Second interspace	9.5	12
Third socket	20	22
Third interspace	8	15
Fourth socket	20	20
Fourth interspace	15±	16±
Combined length of middle three sockets	78	90

A slight asymmetry is thus evident in the rami of opposite sides.

The two roots still in place are broken off at the level of the jaw and are nearly oval in section, with the longest transverse diameter turned outward and forward in the posteriormost but nearly parallel with the tooth row in the anteriormost tooth. In side view are seen several short and shallow depressions in the rami marking the exit of the mental nerves. About halfway up on the ramus a very shallow longitudinal groove is evident, beginning from the most proximal of these exits just in front of the symphysis.

(3) The third fragment referred to this species is a portion of the base of a skull from Mulberry, comprising the occipital condyles (15787 M.C.Z.). These are prominent and rounded, though but slightly marked off from the occipital surface by a raised border. Their greatest vertical diameter is very nearly at right angles to the transverse plane of the skull, and the greatest width is at about the middle point of their height. In measurements they are practically identical with those recorded by Moreno for *D. poucheti*.

MEASUREMENTS OF 15787 M.C.Z.

	mm.
Greatest transverse width across both condyles	144
Greatest vertical diameter of right condyle	93+
Greatest vertical diameter of left condyle	100±
Greatest width of right condyle	57
Greatest width of left condyle	59
Distance between right and left condyles above	41
Distance between right and left condyles below	14
Foramen magnum, vertical diameter	63±
Foramen magnum, transverse diameter	45

It is possible that a cetacean vertebra from Brewster figured by Sellards (1915, p. 105, fig. 33) belonged to a whale of this same species.

SUMMARY

It is evident that the three fossil cetaceans here noticed have much in common with species occurring elsewhere in Miocene formations. The first, *Schizodelphis depressus*, is closely allied to a species represented in the Miocene of Shiloh, New Jersey, if indeed it is not identical with it. The second, *Pomatodelphis inaequalis*, is referred to a new genus that apparently occurs as well in the lower and the middle Miocene of France, where, however, it is represented by a less specialized species. The implantation of the teeth suggests a possible relationship to *Platanista*, though it is considered one of the Iniidæ. The third is closely related to a cetacean described from the lower Miocene of Patagonia and is believed to be identical with a species, *Diaphorocetus mediatlanticus*, discovered in the upper Miocene of Maryland. On the whole, therefore, the evidence of the cetacean remains points to a late Miocene age for these "pebble phosphate" deposits of Florida. The two species of Iniidæ seem to represent the terminal members of a group now extinct, though related to the existing river dolphins. The one Physeteroid is a more primitive representative of a group that has survived to the present day, but whose living members, perhaps through a change from fish-eating to squid-eating habits, have lost the functional teeth of the upper jaw.

LITERATURE

ABEL, O. 1899. Untersuchungen ueber die fossilen Platanistiden des Wiener Beckens. Denkschr. Akad. Wiss. Wien, vol. 68, p. 839–874, pl. 1–4.

CASE, E. C. 1904. Systematic paleontology of the Miocene deposits of Maryland. Mammalia. Md. Geol. Surv., Miocene, p. 3-58, pl. 10–26.

CUSHMAN, J. A. 1920. The American species of Orthophragmina and Lepidocyclina. Prof. Paper, U. S. Geol. Surv., no. 125-D, p. 39-105, pl. 6–35. (See Correlation table facing p. 40.)

Dal Piaz, G. 1903. Sugli avanzi di *Cyrtodelphis sulcatus* dell' arenaria di Belluno. Parte primera. Palaeontogr. Ital., vol. 9, p. 187–219, pl. 28–31, 16 text figs.

Dal Piaz, G. 1905. Sugli avanzi di *Cyrtodelphis sulcatus* dell' arenaria di Belluno. Parte seconda. Palaeontogr. Ital., vol. 11, p. 253–279, pl. 18–21.

Holl, F. 1829. Handbuch der Petrefactenkunde. Part 1. Dresden, 16 mo., viii + 489 pp.

Keferstein, Ch. 1834. Die Naturgeschichte des Erdkörpers in ihren ersten Grundzügen dargestellt. Leipzig, 2 vols.

Leidy, J. 1869. On the extinct Mammalia of Dakota and Nebraska, including an account of some allied forms from other localities. Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 7, p. 23–472, pl. 1–30.

Leidy, J. 1889. Description of vertebrate remains from Peace Creek, Florida. Trans. Wagner Free Inst. Sci., vol. 2, p. 19–31, figs. on pl. 3–6.

Miller, G. S., Jr. 1918. A new river-dolphin from China. Smithsonian Misc. Coll., vol. 68, no. 9, 12 pp., 13 pls.

Moreno, F. P. 1892. Noticias sobre algunos cetáceos fósiles y actuales de la República Argentina conservados en el Museo de La Plata. Revista Mus. de La Plata, vol. 3, p. 381–401, pl. 8–10.

Sellards, E. H. 1915. The pebble phosphates of Florida. 7th Ann. Rept. Fla. State Geol. Surv., p. 25–116, fig. 1–52.

True, F. W. 1908. On the occurrence of the remains of fossil cetaceans of the genus *Schizodelphis* in the United States, and on *Priscodelphinus* (?) *crassangulum* Case. Smithsonian Misc. Coll., vol. 50, pt. 4, p. 449–460, pls. 59, 60.

True, F. W. 1908a. Remarks on the fossil cetacean *Rhabdosteus latiradix* Cope. Proc. Acad. Nat. Sci. Phila., p. 24–29, pl. 6, text figs. 1–3.

True, F. W. 1910. Description of a skull and some vertebrae of the fossil cetacean *Diochotichus vanbenedeni* from Santa Cruz, Patagonia. Bull. Amer. Mus. Nat. Hist., vol. 28, p. 19–32, pl. 1–5.

EXPLANATION OF PLATES

Plate 9

Fig. 1. *Schizodelphis depressus*, sp. nov. Palatal view of basal portion of beak, from near Barstow, Florida. Type, 828 Fla. Geol. Surv. × .39.

Fig. 2. Dorsal view of same.

Fig. 3. *S. depressus*, a fragment from near tip of beak. 5885 Fla. Geol. Surv. × .39.

Fig. 4. Dorsal view of same, showing fusion of intermaxillaries.

Fig. 5. Centrum of a lumbar vertebra referred to *S. depressus*, showing median ridge projecting into neural canal. Mulberry, Fla. 15786 M.C.Z. × .39.

Fig. 6. *Diaphorocetus mediatlanticus* (Cope). Cranial condyles, posterior view. Mulberry, Fla. 15787 M.C.Z. × .43.

PLATE 10

FIG. 7. *Pomatodelphis inaequalis*, sp. et gen. nov. Portion of rostrum, palatal view, showing the asymmetry of structure, and the row of depressions for tips of mandibular teeth internal to the maxillary tooth row. Those of left side partly filled by plaster. *n*, *n*, the blowholes; *v*, vomer. 5834 Fla. Geol. Surv. × .5.

FIG. 8. Dorsal view, showing the entire specimen. × .44.

FIG. 9. *P. inaequalis*, a fragment from near tip of beak, dorsal view, showing fusion of intermaxillaries, and dorso-ventral flattening. 2343 Fla. Geol. Surv. × .75.

PLATE 11

FIG. 10. *Pomatodelphis inaequalis*, palatal view of fragment of right maxilla. The nine depressions for reception of mandibular teeth are indicated by dotted line to center of each. Brewster, Fla. Type. 15750 M. C. Z. × .90.

FIG. 11. Same, dorsal view of summit of skull, showing (outlines dotted): frontals (*f*), bases of intermaxillaries (*i*) and maxillaries (*m*), interparietal (*ip*), and part of supraoccipital (*so*). 5834 Fla. Geol. Surv. × .50.

FIG. 12. Same, posterior view of supraoccipital fragment (above), condyles, and squamosal processes of cranium. 5834 Fla. Geol. Surv. × .50.

PLATE 12

FIG. 13. *Diaphorocetus mediatlanticus* (Cope), base of rostrum in side view, showing teeth in both jaws. Found near Mulberry, Fla., but now lost. (Cut loaned by Fla. Geol. Surv.; see Sellards, 1915, p. 103). × .50.

FIG. 14. Same, dorsal view of jaw fragment from just in advance of symphysis. Brewster, Polk Co., Fla. 15751 M.C.Z. × .83.

Cambridge, Massachusetts.

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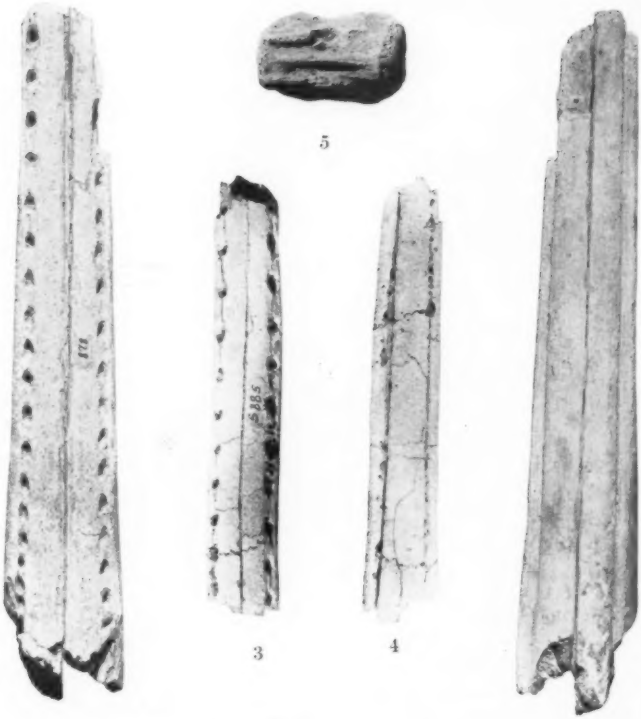

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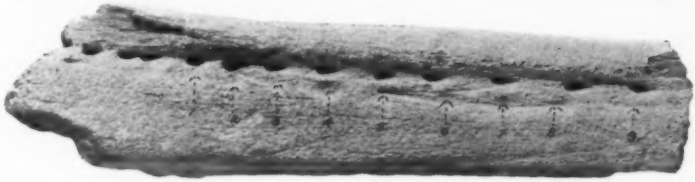

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TWO UNRECOGNIZED SHREWS FROM CALIFORNIA

By Hartley H. T. Jackson

Continued studies upon American Soricidæ for the United States Biological Survey have disclosed two heretofore unrecognized forms from California. That their names may be available for other workers they are here described in advance of the complete report.

Sorex obscurus parvidens subsp. nov.

SAN BERNARDINO DUSKY SHREW

Type-specimen.—No. 56,561, United States National Museum, Biological Survey Collection; ♂ adult (teeth slightly worn), skin and skull; collected October 3, 1893, by J. E. McLellan. Original number 242.

Type-locality.—Spring known as Thurman's Camp, Bluff Lake, altitude 7,500 feet, western side of San Bernardino Peak, San Bernardino Mountains, California.

Geographic range.—Known only from San Bernardino Mountains, California.

Diagnostic characters.—Similar in size and color to *Sorex obscurus obscurus;* skull about the size of that of *S. o. obscurus,* narrower interorbitally, with distinctly flatter cranium, which is less expanded mastoidally (consequently the skull averages narrower in greatest lateral diameter); molariform teeth more deeply emarginate posteriorly, the unicuspids narrower, and the first incisors smaller.

Color.—Winter pelage: Unknown. Probably not essentially different from winter pelage of *S. o. obscurus. Summer pelage:* Similar to that of *obscurus;* upperparts between olive-brown[1] and buffy-brown, tending slightly toward Soccardo's umber, and gradually blending with color of underparts; underparts smoke gray more or less tinged with avellaneous or light ochraceous-buff; tail distinctly bicolor, olive-brown above, buffy brown below, darkening toward tip.

Skull.—Narrower interorbitally than that of *S. o. obscurus,* with narrower and distinctly flatter braincase, and, on the average, weaker dentition, the molariform teeth usually with more deeply emarginate posterior borders.

Measurements.—Type-specimen: total length, 105; tail vertebræ, 45; hind foot, 12.8 (measured from the dry skin by the writer). *Skull* of type-specimen: condylobasal length, 17.1; palatal length, 6.7; breadth of cranium, 8.1; interorbital breadth, 3.5; maxillary breadth, 5.0; maxillary tooth row, 6.2.

Remarks.—Only 6 specimens of this shrew have been examined, 4 of which are in Biological Survey Collection and the other 2 in the

[1] Colors here used are those of Ridgway, R., Color standards and color nomenclature, 1912.

collection of Mr. Donald R. Dickey, Pasadena, California. The rather flat and narrow skull of *Sorex o. parvidens*, combined with its weak dentition, distinguish it from other forms of the species *obscurus*.

Sorex pacificus sonomæ subsp. nov.[2]

SONOMA SHREW

Type-specimen.—No. 19,658, Museum of Vertebrate Zoology, University of California; ♂ adult (teeth moderately worn), skin and skeleton; collected July 2, 1913, by Alfred C. Shelton. Original number 227.

Type-locality.—Sonoma County side of Gualala River, Gualala, California.

Geographic range.—Coast region of California from Point Arena, Mendocino County, south to Point Reyes, Marin County.

Diagnostic characters.—Similar to *Sorex pacificus pacificus* but averaging smaller, and a trifle darker and less reddish in summer pelage.

Color.—Winter pelage: Essentially like that of *Sorex p. pacificus*. *Summer pelage*: Averaging somewhat darker and less reddish than that of *S. p. pacificus;* scarcely more reddish or cinnamon than in winter pelage. Upperparts mummy brown or fuscous, the color of the upperparts extending well down over the sides; underparts between olive-brown and buffy brown, tending toward sepia; tail essentially unicolor, about same color as underparts.

Skull.—Similar to that of *Sorex pacificus pacificus*, but averaging smaller.

Measurements.—Type-specimen: total length, 133; tail vertebræ, 59; hind foot, 16. *Skull* of type-specimen: condylobasal length, 21.1; palatal length, 8.9; breadth of cranium, 10.3; interorbital breadth, 4.5; maxillary breadth, 6.3; maxillary tooth row, 8.1.

Remarks.—The southern form of *Sorex pacificus*, here described under the subspecific name *sonomæ*, is separable from true *pacificus* only in average differences of size and color. There are occasionally small specimens of the subspecies *pacificus* which match fairly well the larger specimens of *sonomæ*. On the whole, however, the differences are clearly marked.

U. S. Biological Survey, Washington, D. C.

[2] I am indebted to Dr. Joseph Grinnell, Director of the Museum of Vertebrate Zoology, University of California, for the privilege of describing this shrew from the collection under his administration.

THE COAT COLOR OF MOLES

By Loye Miller

Castle,[1] in his studies of color inheritance in various domestic rodents, learned that the gray coat of wild rabbits is highly complex in its nature, the resultant of joint action of several independent factors, and that the various color phases known to the rabbit fancier are but the effect of weakening or loss of one or more of these factors. He recognizes in the rabbit no less than eight such factors and offers as evidence of their presence, the mathematical results obtained in cross breeding. Any one who will follow the account of his experiments with some measure of care will perforce admit the weight of his conclusions and will concede that the methods of analysis by careful pedigreed cross breeding approach in accuracy the work of an analytic chemist.

The eight factors established for the rabbit are as follows:

1. A color factor, necessary to the formation of all pigment and absent in albinos.
2. A factor for black.
3. A factor for brown.
4. A factor for yellow.
5. A factor for intensity of color.
6. A factor for pattern of individual hairs.
7. A factor for self coloration, i.e., no white spotting.
8. A factor for extension of dark pigments from extremities of ears and feet.

This formidable array of color factors, each acting as an entity in transmission through the generations, can be proven only from the record of tremendous numbers of cross matings under absolute control, hence such proof is out of the question in a wild race. However, by taking account of seeming parallelism and by making use of the occasional sporadic aberrant that comes to the hand of the field naturalist, some pardonable conjecture may be formulated.

The very interesting account by Patterson[2] of a cinnamon phase of the roof rat, developing in Travis County, Texas, represents such a case. The rat in an animal that can usually be kept in captivity and reared in large numbers, so attempts to breed the new cinnamon roof

[1] Castle, W. E., Studies of Inheritance in Rabbits, Carnegie Inst. Publ., 1909, p. 45.

[2] Patterson, J. T., Science, n.s., vol. LII, no. 1341, p, 250, 1920.

rat are doubtless ere this proving successful. Results with some of our less domestic and less amenable animals are harder to obtain, hence any light that the field naturalist can shed upon the subject should be welcomed. It is to encourage the reporting of such sporadic cases and possibly to contribute to a slowly accumulating fund of evidence, that this note is offered for publication.

An abnormally colored specimen of the southern California mole, *Scapanus latimanus occultus*, was recently placed in my hands by a student who had captured it in a gopher trap in the city of San Gabriel, California. The specimen is, to my way of thinking, far more interesting than an ordinary case of albinism. It is not an albino but is light cinnamon yellow in color. This pigment, with the glistening quality of the mole's fur, results in a beautiful golden effect quite pleasing to the eye. It seems to me that this particular blunder on the part of nature has an even greater interest beyond its beauty in that it may throw some light upon the color composition of the mole.

The normal color of the species under discussion is, at first impression, a uniform slate gray with silvery reflections. This uniformity is notable in nestlings, in half grown, and in adult specimens. It applies to the individual hair from practically its base to its tip as well as to the entire body of the animal. Only on the extreme margins of the lips or upon the nearly bare feet and tail do we find a lighting up of the dark slate monochrome by whitening of the hairs. The simplest conclusion would be that color in the mole is due to a single heritable factor even as color in the human negroid was at one time supposed to be. Those who have seen the startling results of segregation of determiners displayed in red-haired mullatos may be ready to concede the possibility of complexity in the slate monochrome of moles.

MICROSCOPIC STUDY OF THE HAIR

The fully developed hair of the southern California mole is a structure of varying diameter with very thick cortex and relatively small medulla. A succession of three or four constrictions of both cortex and medulla, resulting sometimes in complete loss of the latter, is noticeable between base and tip of hair. The hair is narrow at its base and is widest in a region near the tip whence it begins to taper off to a point. Along the medulla the pigmented areas appear as dark masses resembling bubbles of india ink regularly distributed along a capillary glass tube, except that they are more like discs than bubbles

and their thickness is commonly less than their diameter. The space between discs is but slightly greater than the thickness of the disc. In the regions of constriction the form of the color masses becomes modified by a reversal of proportions and they become elongated to styliform proportions before being finally pinched out by loss of the medulla. Throughout the major portion of the hair the colored areas appear perfectly black. However, where they are thinned out by terminal or intervening constriction of the medulla the last ten or twelve become progressively less purely black until the terminal style appears dark umber brown. This appearance is less marked in the intermediate constrictions than in the terminal one and is nowhere revealed except by careful scrutiny. The proportion of these brownish areas is so small and the difference in color is so slight that the effect is entirely lost in viewing the pelt as a whole.

The cortical part of the hair is glistening white and clears to almost complete transparence. Only at rare and irregular intervals is a slight rusty stain visible. The thickness of the cortex and its freedom from color are probably responsible for the silvery sheen of the mole's fur.

Hairs were cleared in carbol-xylol to reduce the effect of air bubbles in microscopic study.

HAIR OF THE NESTLING MOLE

In a nestling so young that the hair lies flat and is quite stiff, the color is identical with that of the fully adult animal. There is the same monochrome pattern of the pelt as a whole, and the same lack of pattern in the individual hair, except where constriction, obliterating the medulla, leaves but the silvery cortex. In the specimen at hand the hair is so short that there is but one of these constrictions, that at the base of the hair, instead of three or four as seen in the adult. There can be no question then that the hair is fresh and unabraded. There appears the same slight rusty stain in the cortex in about the same degree as in the adult. The color areas are indistinguishable from those of the adult. Where the pigment becomes thinned out at the constrictions, the same umber brown is evident. It is a question then, so far as microscopic study of the normal mole is concerned, whether the color area carries a single pigment which is so darkly brown as to appear black or bears a black and a yellow pigment intimately commingled. Study of the hair with the oil immersion lens failed to disclose a commingling of individual granules of pigment of different colors. If

there be a genetic complex of color determiners present in the mole, as has been demonstrated for various rodents, it can not be seen that they affect different granules. The commingling must be ultramicroscopic.

STUDY OF THE XANTHIC SPECIMEN

The aberrant specimen that precipitated this discussion shows no departure from the normal beyond that of the color areas of the hair. Palms, soles, claws, and the nearly naked skin of the tail and the nose are, like those of the normal animal, practically without pigment and I can distinguish no difference between the two color phases in respect to the coloration of these parts. In preparing the skin, the eye rudiments were visible and there was noticed no difference between them and the rudiments in normal moles. Unfortunately no microscopic examination of these parts was made, so we lack proof for the assumption that the eye color was normal.

Microscopic study of the hair shows no divergence from the normal except in the matter of color of the pigment. The color areas are present and they in every other respect correspond with those of normal moles, but they are light brownish yellow instead of dense black in tone. They are readily marked off from the adjacent spaces and from the colorless cortex. The same styliform effect occurs where the medulla is constricted. Altogether, there is no reason for considering the specimen as an albino in which the whole machinery of pigmentation is lacking.

Whatever the theory of pigmentation toward which one may lean, it seems to me that this specimen represents the result of a factor dropped out, a chemical radical split off, a poverty in tyrosinase, or what you will, and that it serves somewhat to prove the complexity of color in a seemingly simple monochrome species of mammal.

Southern Branch Univ. of California, Los Angeles, Calif.

GENERAL NOTES

BATS ON MIGRATION

It may interest students of bat migration to know that the British Museum has received from Mr. P. E. Cheesman two specimens of the silver-haired bat (*Lasionycteris noctivagans*) and one of the red bat (*Lasiurus borealis*), which were obtained out of a flock of about a hundred which caught up with and settled on Mr. Cheesman's ship some twenty miles off the coast of North Carolina on the 3rd of September, 1920. The special interest of the record is that these two species were migrating in a considerable flock some way out to sea and in company with one another.—OLDFIELD THOMAS, *London, England.*

THE NEST OF THE WASHINGTON WEASEL (MUSTELA WASHINGTONI)

On July 17, 1920, while setting a biological survey line of traps in the flats of the Nooksack River, at Excelsior, Whatcom County, Washington, in a thicket almost purely of salmonberry bushes, I was casually observing the mountain beaver burrows occurring in this locality. One burrow looked especially fresh but unusually small. Stooping, I was surprised to see, deep down in the burrow, the head of some small creature like a weasel. It drew back almost at once, so a wooden and a steel rat trap, both baited with the skinned body of a small mammal, were put down.

By evening a large female weasel, apparently the mother of those captured later, was taken in the steel trap. Next morning both traps were found untouched. By evening two nearly fullgrown weasels were taken at the same time, one in each trap. Both were males. Next morning another young male was taken in the steel trap.

It appeared that here might be a nest, for there were some indistinct though clearly worn trails leading through the salmonberry bushes to the hole, with here and there a bird feather scattered about. The hole itself, 2.5 inches in diameter, was driven between the roots of the salmonberry bushes and kept open by them. The animals had gnawed the bark from those roots adjacent to the hole to make the entrance larger. That large bluebottle flies were passing in and out this burrow not only suggested the presence of a nest but that the den might be occupied by a carnivore.

After posing and photographing the adult female, we dug into the burrow to search and found that it almost immediately entered a mountain beaver den. There, in an enlargement of one of the twisting burrows, we found a nest, about as big as a dinner plate, made of moss, and resembling a grouse nest. Under this present nest between it and the entrance were the remains of what seemed to be a very old nest, which would suggest that this den had been used in former years and had possibly functioned also as a winter nest.

The main den seemed to be inhabited by the mountain beaver as well, as fresh earth was thrown out of a burrow within a few feet of the weasel nest.

The exact dimensions of this nest are as follows: Diameter from surface of the ground to bottom of the nest, 18 inches; distance from top of ground to top of nest cell, 5 inches; diameter of nest cell, 13 inches by 14 inches; diameter of actual nest, 9 inches by 9 inches; dished portion of the nest, 2 inches deep; distance dug

by weasel from *Aplodontia* burrow to surface of ground, 13 inches; distance from exit of weasel burrow to center of nest, 30 inches.—WILLIAM T. SHAW, *State College of Washington, Pullman, Washington.*

THE SEA MINK, MUSTELA MACRODON (PRENTISS)

There are traditions along the coasts of Maine, New Brunswick, etc., of a gigantic mink known as the sea mink, which was commonly trapped there during the early part of the nineteenth century. It disappeared about 1860. It is just possible that this was really the *macrodon* of Prentiss, 1903. If so, it is likely that specimens were preserved. It was the custom in the small hotels of the above region to have mounted any local animal of unusual interest in point of size, etc. These rarities were kept in glass cases as parlor ornaments or as barroom accessories. If some of our travellers this summer would keep a lookout for monstrous minks in glass cases, and inquire also among the old-timers for information about the sea mink, we might get interesting details, or even specimens.—ERNEST THOMPSON SETON, *Greenwich, Conn.*

THE CURIOSITY OF THE PROWLING MINK

As I slipped from the wet trunk of a windfall down into the snow, I noticed the trail of a mink leading away through the scrub pines. On account of the high elevation of the wooded hill, the distance from any pond water or brook and the deep snows and the scarcity of birds and small prey, I was somewhat surprised at the find. I looked back of the windfall and noted no trail; I scrutinized the snow on the dead trunk of the tree where the branches were heavy with needles and snow-gobs, and not three feet from my hand marks appeared the small foot prints. In the future I shall at all such times pause and look about. No other tracks appeared, only those on the trunk and the lone trail among the pines. Trees stood close to the windfall, while pine boughs swept low, so that the animal must have been traveling overhead and have dropped to the trunk below. The only birds in the woods were a few chickadees, crows, and blue jays. I have not heard of the mink as a tree-haunter or a tree-traveler; that is, of his using the interlacing boughs for any distance. In approaching the windfall I had crossed only a pheasant's track some fifty yards back, and I had noticed the trail sharply for the tracks revealed that the bird had visited every weed head sticking above the snow, diligently hunting for seeds. Weeds were few and far between, for there was some three feet of snow under a heavy crust, and upon this lay a light fall of powdery stuff some two days old. An examination of the mink trail proved it to be practically fresh, made during the night or early morning, as light forest winds had not dusted or drifted the tracks.

I decided to follow the trail and see what the animal had done on his widely ranging prowl. It led at a leisurely pace, at a seeming walk, as though time were an illusion and prey a thing unknown. Thick clumps of young birches were occasionally visited, but only such as grew in the set direction of the trail. Again, when pine boughs bending with snow swept the ground the tracks searched the shelters beneath and passed on. Pheasant and ruffed grouse tracks crossed and re-crossed, but the mink never seemed to halt in its journey over these.

Beneath a large pine the snow had fallen away from the trunk, leaving a deep hole around it; the mink circled this on the very edge. So through the woods. Only once did the animal break into a run which led it to the top of a small knoll overlooking a clearing bordered with groups of white birch, then it fell again into that leisurely pace across the untrod snow. The distance was nearly a mile to the edge of the woods.

A large pasture appeared which sloped down into a low meadow where small trees and shrubbery grew sparingly. The mink paused at the top of the slope. Then it made a half circle or sortie to one side and left a small amber colored spot on the snow, then the tracks shot straight down the slope. Halfway down a number of pheasant tracks cut across lots; the birds had dropped a number of pellets and the mink jumped to one side to sniff at these. Beyond the lowlands stood a wall of hemlocks, and among the boundary trees grew willow, alder and birches. Towards these ran the trail, straight to a brook which lay half buried under the snow.

At this point the tactics of the mink underwent a change; back in the woods the animal had seemed to be an idle prowler who merely glanced over prospects and never veered from a practically straight trail to explore even a rotten stump a yard or so to one side; while at the brook it seemed full of stealth and craftiness. The animal now became the seeker, the hunter, the killer. It jumped from the low bank into the water where grass swung lazily in the current; its tracks appeared on the opposite shore where it made a wide circle of survey and turned to the brook again. The water was shallow in places, deep toward and under the south bank, and I knew of nothing the mink could stalk there unless it were a stray sucker, trout or muskrat. Long reaches of the stream were entirely roofed over with snow. The mink took the tunnel-way, and at one place it went in, came out and walked over and then followed the irregular shore again. Now it turned abruptly from the stream, paused under a little beech where white-footed mice had tracked the snow in every direction, trotted some fifty yards out on to the smooth floor of the meadow and turned to the brook again. What prompted this foray? The brook now ran under steep banks and was quite hidden. Once again the prowler kept me to an interesting pursuit. No spot along the brook or in the waters escaped its notice. No trails appeared, only those of the mink I was following. It ran up and down, over and around, back and fourth, from one bank to another. No evidence appeared of any kill or success in its hunting.

Downstream a bit, the brook widened; the ground became marshy and hummocky. In the center of a clearing stood an old hemlock, broken off some fifteen feet above the ground. In the upper end of this relic the openings of a number of woodpecker holes appeared. The mink left the brook and in a number of leaps came to the base of the trunk. Bits of bark on the snow showed it had climbed up to explore those holes for an unlucky downy or hairy woodpecker. Beyond the tree ran the tracks of a ruffed grouse, and these it followed along the hemlocks for some distance and then doubled on its trail back to the brook. A little farther downstream the animal deliberately walked through a steel trap, but the trap had been set long, was matted in the grass and partly covered with brook rubbish. Only a small stick, barely noticable, served as a marker. I do not know whether luck was with the mink or whether it knew that the trap was harmless. As the banks became higher the brook began to be completely roofed over. The mink

trail led to the water at this point, and a walk downstream failed to discover any trace of more tracks wherever an opening appeared.

It is known that the mink is at times a traveler. In the woods the animal did not seem to enter into the pursuit of any prey. Pheasant and ruffed grouse were abroad but were not common. I found nothing of a kill. A greater portion of its trail was made at a walk which we know is a method of slow locomotion for the animal. Its usual gait is a series of fast, easy bounds. Was this animal hunting? Was hunger stalking the woods and swamps? This happened during the winter of 1920, in February, when the snowfall throughout New Hampshire was of unusual depth.—EDWARD CHARLES HOBSON, *Lowell, Massachusetts.*

THE BADGER AS A SWIMMER

In the mid-afternoon of August 4, 1920, a badger (*Taxidea taxus taxus*) was found swimming in the middle of Devils Lake, North Dakota. Mr. T. H. Hubbell and I were crossing in a motor-boat from Minnewaukon Bay to Creel Bay when we noted the animal in the water a half-mile or more from the north shore, and also about a half-mile from the south shore. It was swimming with apparent ease toward the north shore, and was making rapid progress. When secured the individual proved to be a fully grown female. The specimen is preserved in the Museum of Zoology of the University of Michigan. The day had been hot and bright—conditions apparently not favorable for the wandering of this species. No one in the region, so far as could be learned, had ever before heard of a swimming badger, and I can find no published reference to such a habit.—N. A. WOOD, *Museum of Zoology, University of Michigan, Ann Arbor, Mich.*

REMAINS OF A FOSSIL PHOCID FROM PLATTSBURG, NEW YORK

In 1901 the New York State Museum received from Dr. D. S. Kellogg, Plattsburg, New York, the tibia of a seal which had been recovered in October of that year from the post-glacial clays within the city limits. The bone was found at a depth of eleven feet below the surface during the construction of a sewer trench on Bailey Avenue. The soil at this locality was said to consist of a layer of sand four or five feet thick overlying fine clay. Fossil marine shells, *Macoma greenlandica* (Beck), were abundant in the upper part of the layer of clay but none were found at the depth of the imbedded bone.

The specimen has been examined by Mr. Remington Kellogg of the Biological Survey and the following statements quoted from a recent letter will indicate its affinities. "A young individual of *Cystophora cristata* (No. 14013, U. S. N. M.) from Newfoundland . . . . shows a very close approach to the fossil tibia. The lower extremity is approximately the same, including the facet for the fibula. The curvature of shaft and angle formed by the suture for the epiphysis of head, same as in *C. cristata.*" The shaft of the tibia of the fossil specimen is a little thicker in the median region than is the condition in *C. cristata.* Although similar in essential characteristics to the recent specimen with which it was compared, it is perhaps best, on account of the fragmentary condition of the remains, to record the bone as the left tibia of a fossil phocid near *Cystophora cristata* Erxleb.—SHERMAN C. BISHOP, *New York State Museum, Albany, N. Y.*

AN OUTSIDE NEST OF A FLYING SQUIRREL

In many localities there have been no records of outside nests built by flying squirrels, therefore it seems advisable to record such observations in order to ascertain how widespread this practice is.

During the summer of 1920 I spent several weeks at Point Pelée, Ontario, collecting material for small habitat groups. On June 24 I found the outside nest of a flying squirrel (*Sciuropterus volans*) in a small tree covered with climbing bitter-sweet. A tall walnut tree four feet away gave the elevation necessary for the squirrels to "fly" to their permanent home, which was in a natural cavity of an oak sixty feet distant. Upon climbing to the nest, I found it contained one young, naked and blind, but my discovery evidently prompted its removal before the following day. The nest was constructed entirely of red cedar bark, and lined with fine, soft shreds of the same material. It was roughly ovate in shape, with the entrance near the top, at the end towards the tree trunk. The branches and vines supported it from all angles against the wind, and its compact structure and sheltered position in the vine made it fairly waterproof. In this instance it seems that the flying squirrel is an architect comparable with other squirrels. —L. L. Synder, *Royal Ontario Museum of Zoology, Toronto, Ont.*

BEAVER "FORMS"

Although most persons who are familiar with the habits of the beaver in its native haunts must surely have seen the "forms" or resting places of the animal, yet I have failed to find mention of them in any of the literature on the beaver with which I am acquainted.

These forms, of which I have examined several in northeastern Minnesota, are not unlike those of the varying hare, except of course in the matter of size. They seem, so far as my observations extend, to be used merely as resting or sunning places during the day time, the animals returning to them daily. I have seen no indications that they are used as feeding places; they are, as a rule conspicuously free from peeled sticks; this is also true for their immediate vicinity. Whether the animals found in these forms,—I know of them only in the summer months—are males, whose presence in or about the lodges may be more or less unwelcome to the mother beaver during the time when she is rearing her young; whether they represent unmated individuals of either sex; or whether indeed they may be referable to any particular class of individuals, I cannot say. However, a specimen which I once trapped in one of these forms was a male.

All of the forms that I have seen were more or less shallow depressions in the ground, roughly oval in outline. One such form, which was occupied by a very large beaver, was situated on a muddy bank under some overhanging alders. It was approximately twenty inches in its greatest length and two inches in depth, and was littered with small chips or shredded wood. Another was in a natural depression between two slightly projecting slabs of rock and contained a rather scant bedding of dry twigs and grass. In dry situations I have seen them without litter of any kind, merely shallow depressions in the bare earth.

In most instances the forms were situated close to the edge of the bank, a couple of feet or such a matter, so that the animal could quickly reach the water.

One examined last summer was located on a low river bank, among some willows and other shrubbery, about ten feet from the water; but within two feet of it was a hole about ten inches in diameter which led into an underground channel connecting with the main stream. The beaver escaped with a sudden rush and a plunge into the water hole.

Of the several forms which I took the trouble to examine, all but one were occupied by the beaver at the time they were discovered. The majority were happened upon during the forenoon but at least two that I recall were found in the early afternoon. In one instance, where the form was located in a sunny, grassy spot at the edge of a stream, my companions and I returned, near the middle of the forenoon, next day, and by exercising caution approached by canoe to within six feet of the beaver as it lay very still in its form. While I was standing erect in the canoe endeavoring to get a better view for a camera snapshot, the animal took alarm and with startling suddenness scrambled and slid into the water. While it lay in the form its head was unfortunately hidden from view and I could not see whether the animal was taking a nap or merely enjoying a sun-bath.—CHARLES EUGENE JOHNSON, *University of Kansas, Lawrence, Kan.*

HORN SHEDDING IN YELLOWSTONE PARK

Records for the shedding of horns by elk, deer, and antelope in the Yellowstone National Park for a number of years are as follows:

Season 1911–1912.	Elk, March 22–April 28.
1912–1913.	Elk, March 20–May 1.
1913–1914.	Mule deer, February 24–March 13 (spike April 13).
	Elk, March 27–April 21 (spike May 15).
1914–1915.	White-tail deer, January 29–March 1.
	Mule deer, February 23–March 27.
	Elk, March 16–April 16.
1915–1916.	(Absent from the Park.)
1916–1917.	(Absent from the Park.)
1917–1918.	Pronghorn, November 15–December 2.
	White-tail deer, February 10–March 4.
	Mule deer, February 25–March 28.
	Elk, March 12–April 30.
1918–1919.	(Absent from the Park.)
1919–1920.	Pronghorn, October 20–November 25.
	White-tail deer, January 15–February 20.
	Mule deer, January 6–March 25.
	Elk, March 19–May 4.
1920–1921.	Pronghorn, October 31–November 28.
	White-tail deer, January 20–February 10.
	Mule deer, February 3–February 25.
	Elk, February 28–April 21.

It is quite usual for the "old-timers" to say that early shedding is a sign of an early spring. But such does not seem to be the case. It would appear that the condition of the animals is the main factor; and since the healthy condition of the animals on the open range is largely dependent on the forage, it would seem

that the comparative dates of horn shedding are more or less directly connected with the growth and condition of vegetation during the summer preceding the shedding season. Take the above dates for 1917–1918, which were late. The spring of 1918 was extremely early but the shedding dates were very late, and the reason is evident from the record of conditions during the summer of 1917. The winter of 1916–1917 was a hard one and the spring was very late; the forage started late and the short season did not permit it to cure properly. The horned animals did not get the usual abundance of food; the horn growth was not as strong as usual, and did not mature so early. As the horns seem to be carried about the same length of time each year, the late maturity caused a late shedding.

On the other hand the season of 1919 was early, hot, and dry, with very little forage. The horns grew at the usual rate for there was enough food during the growing period of the first half of the year. But the animals were not as strong and fat at the beginning of the winter. Then the winter was very snowy and cold and the weakened condition of the animals led to the early shedding of 1919–1920, although the succeeding spring proved one of the latest ever recorded.

The early shedding by weak and sick animals was very noticeable during the winter of 1919–1920. An old, one-eyed mule deer in evident poor health shed the first horn on December 22 and the remaining one on the 25th of the same month, and shortly afterwards died. An elk was seen on January 18 who had just shed both horns, and this animal did not live through the winter either. Since the shedding by both these animals was so evidently due to poor health, the dates are omitted from the above tabulation.—M. P. Skinner, *Yellowstone Park, Wyoming.*

A "SILK BUFFALO" ROBE

I have in my possession a buffalo robe, an heirloom in my family, which, with a similar robe, was given to my grandfather, Martin Bates of Boston, sometime between 1840 and 1850, by Pierre Chouteau, the fur trader of St. Louis, with whom my grandfather had business dealings. As the elder Pierre Chouteau died in 1849 at the age of one hundred, it is to be presumed that his son, Pierre Chouteau, Junior, was the donor of the robes. The other robe was sold, and was inferior to the one I have. This one has been in the possession of the family ever since, though no use has been made of it. My uncle, the late Charles S. Bates, son of Martin Bates, gave the robe to his niece, and told her that it was called a silk buffalo, that it was very rare and highly valued.

The hide was tanned by the Indians, and was sewed by them on the right side with sinew threads. As this made heavy ridges which might wear away the hair my cousin had the seams ripped and sewed on the other side. The skin is 70 inches long, 65 inches wide just behind the forelegs, and 71 inches wide in front of hindlegs. The dorsal area is light brown in color, with a slight drab tone in some lights. The sides are dark, almost black on the front legs. Most of this long time the robe has been kept in the dark, so that it seems probable that it has faded little or none. The hair on the back is fine, short, and curly, apparently from one to 1½ inches long, and in texture it is very soft; I suppose it might be called "silky." I have no other bison skin at hand for comparison, so cannot say if it is really any softer than the average robe. I have made a few inquiries

about such robes, but without gaining any information. Dr. W. T. Hornaday told me he had heard of them, but had never seen one.

My cousin, Miss Bates, was in the Canadian Rockies in 1906, and the guide who took her on some of her trips showed her a photograph of his family, and called attention to a skin on which the group were seated, saying that it was a silk buffalo, killed on the Canadian prairies. The guide's father was an early settler in that region, and got the skin when he first came out. The guide spoke of its rarity and value, and was much surprised and interested to learn that my cousin knew about them and owned one. Both he and my uncle said that in a large herd occasionally one of these fine silk animals was found, but never more than one.

Mr. David N. Heizer of Colorado Springs informs me that in Kansas, after the civil war, the young buffalo bulls in November were said to be in the silk.

Can any of my readers give me any information about these skins? I am naturally somewhat curious to learn if there is really any truth as to the rarity and value of these fine-haired skins.—EDWARD R. WARREN, *Colorado Springs, Colo.*

THE CALIFORNIA GRAY WHALE ON THE COAST OF SOUTHERN CALIFORNIA

Recent writers on our Cetacea have stated that the California gray whale (*Rhachianectes glaucus*) is extinct on our coast and is, at this time, found only in small numbers along the coast of Japan. Some have gone so far as to state that it is twenty years since the last of the California grays appeared on the American coast. As I had considered this species one of our most common whales, when I left this part of the coast twenty-three years ago, I found it hard to reconcile these records with my own observations.

A trip to the Coronado Islands, twenty miles south of the harbor of San Diego, March 5, 1921, gave me the first, and, to date, the only chance of observing whales; and I was gratified to see two fine male California gray whales under conditions that rendered identification beyond question. These were the only whales of any species seen on the trip. They were northward bound and evidently migrating.

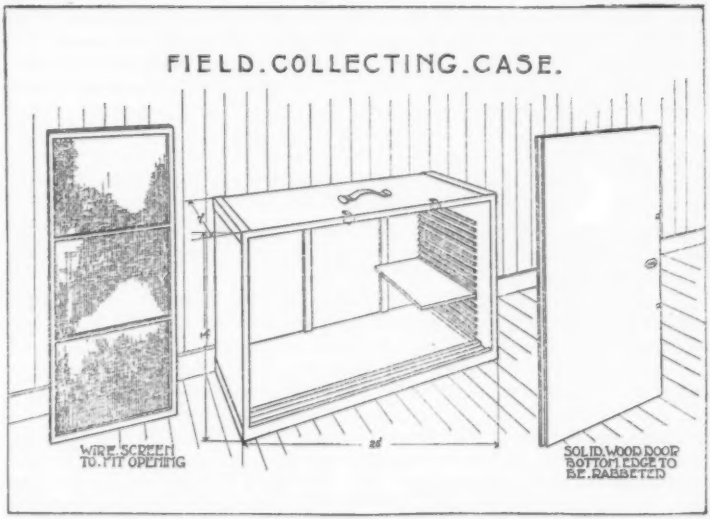
When I first came to the coast of southern California, in 1887, there were still to be found many of the old time whalers who had, from the earliest history of the whale fishery, followed the "shore whaling," hunting the "fish" from shore stations with hand-irons. These men knew the several species of our Pacific whales as they will never again be known. The present generation know little of our whales, and care less; and it is hard to obtain, at this time, any reliable data.—A. W. ANTHONY, *San Diego, Calif.*

A HANDY COLLECTING CASE

The case for drying and carrying specimens of birds and small mammals, shown in the accompanying drawing, is the handiest and most useful case for certain field work that I have ever seen. Upon my showing it to Dr. Walter P. Taylor, of the U. S. Biological Survey, during a recent visit of his to the California Academy of Sciences, and my explaining to him its main features, he asked me to send a description of it to the *Journal of Mammalogy* so that others might benefit by it.

As shown in the drawing, the case is 25 inches long by 14 inches high, and 7 inches deep, outside measurements. While these dimensions may be varied at will, they are those of a fairly large "suit case," and this size is handy to carry, to stow away in passenger coaches or automobiles, and will sling well on a pack saddle.

This case is made of some light, tough wood, ½ inch in thickness, reinforced at the ends with angle irons or brass. The solid outer "door" of the case is of the same material as the main body of the box, but its ends are strengthened by a strip running across grain, nailed, screwed, or glued on, as is usually done in such construction.



The shelves are of ¼ or $\frac{3}{16}$ inch wood that must be soft enough to take pins well. Five shelves to a case are ordinarily sufficient for average collecting. As shown in the cut, the cleats for the shelves do not extend quite up to the top, and when not in use for specimens the shelves can all be stowed away in the upper part, leaving the rest of the box clear for packing material and supplies, such as mouse traps, cotton, or anything not too heavy.

The cleats are short enough, and the shelves narrow enough to allow the screen door to lie between them and the outer door, so that when the latter is removed, the screen is in place to protect specimens from flies, mice, cats, etc. The frame for this wire screen should be made of tough, straight-grained wood, as it is of light construction and must stand handling in taking out and putting in place, as well as an occasional fall.

Freshly prepared skins of birds or rodents, when properly pinned to the shelves, withstand the jolting of carrying by hand and of ordinary travel in good shape, but will not resist the attacks of the average "baggage smasher," of course.

The cut shows a couple of thin perpendicular strips in the rear of the case. These are so placed as to allow the passage of air behind the shelves for the better ventilation and more rapid drying of specimens. The wire side of the screen door must always be turned to the rear so that the frame will present something for the fingers to grasp in handling.

A lock is put on the solid door, and two pieces of metal are secured in slots so as to drop down and act as catches. When the outer door is removed for drying specimens these will also keep the screen door in place. These catches, as shown in the cut, could be improved upon, or small flat bolts might be set in the door instead, so long as everything is flush with the surface. Some sort of a trunk handle on the top of the case, and a leather "tab" fastened with screws on the door to aid in handling it, complete the job.—Joseph Mailliard, *California Academy of Sciences, San Francisco.*

RECENT LITERATURE

Dixon, Joseph. Control of the Coyote in California. Berkeley, University of California Press, Bull. no. 320, College of Agriculture, pp. 379–397, 7 figs., April, 1920.

In this bulletin the author has succeeded admirably in presenting a concise and fair statement of the economic relations of the coyote in California and the measures proposed for its control. To those who would regret the passing of the coyote, Dixon's demonstration of the fact that "a coyote is not necessarily a bad citizen" will be welcome. With prime coyote pelts selling up to $10 and even $20 each the fur value of the animal is not to be minimized. Add to this the beneficial activities of the coyote in destroying noxious rodents, particularly ground squirrels, and it must be conceded that the economic value of the animal is a real and not an imaginary quantity. Of course, adverse testimony is not lacking. The coyote is stated to be the most destructive carnivorous animal now existing in California, and reference is made to depredations on deer, sheep, pigs, and calves. Furthermore there is, at times, grave danger of the spread of rabies through coyotes to horses, cows, goats, dogs, cats, and other domestic animals as well as to man. Consequently control measures are essential.

The bounty system is unreservedly condemned, as being vastly expensive, productive of endless fraud, and failing to give general or permanent relief. Coyote proof fences give good results under favorable conditions. The four most effective methods of destroying coyotes are stated to be trapping, poisoning with strychnine, digging out dens containing young, and shooting. It is Dixon's opinion, on the basis of results obtained in Nevada and parts of California, that cooperation in coyote control between the State and Federal governments through the Biological Survey is much superior to the bounty system. This work, supervised by the government, is carried on upon a half-and-half basis. Experienced trappers are employed on a salary and are not permitted to accept bounties from any source.

As a necessary result of the destruction of the coyote man will have to face the problem of accounting for the thousands of ground squirrels which the animals destroy each year, as Dixon clearly points out. Control measures breed control measures. Control in one direction throws nature out of balance and often gives rise to troublesome consequences which must be dealt with through additional control measures.

The case has recently been well stated by two British authorities. Watt (Journ. Ecol., vol. 7, Nov. 1919, pp. 201–202) cited herbivorous animals as a chief cause of failure of natural regeneration of the oak in Britain. As a result of the reduction in numbers of carnivorous animals there has been a general increase in rabbits, mice, moles, and certain birds. "Man by upsetting the balance of nature, and assuming control of what directly affected his own interests, is now paying the penalty in other ways, and must, having killed or suppressed the controllers, either assume total control himself or assist in such by a judicious encouragement of those animals he once considered his inveterate foes." The same point is made by Lankester, quoted by Watt, ". . . . civilized man has proceeded so far in his interference with extra-human nature, has produced for himself and the living organisms associated with him such a special state of things by his rebellion against natural selection and his defiance of Nature's pre-human dispositions, that he must either go on and acquire firmer control of the conditions or perish miserably by the vengeance certain to fall on the half-hearted meddler in great affairs. We may indeed compare civilized man to a successful rebel against Nature who by every step forward renders himself liable to greater and greater penalties, and so cannot afford to pause or fail in one single step." (Kingdom of Man, 1911, pp. 31–32).

—*Walter P. Taylor.*

Pohle, Hermann. Die Unterfamilie der Lutrinae. (Eine systematisch-tiergeographische Studie an dem Material der Berliner Museen.) Archiv f. Naturg., 85 Jahrg. (1919), Abt. A, 9 Heft, pp. 1–247; 19 text figs., 10 plates. November, 1920.

The recent and fossil otters of the world are treated in this extensive monograph. An examination of the systematic part (pp. 1–174) leads one to believe that the material available to the author in many groups hardly justified so pretentious a work. But he has drawn liberally upon the literature of the group and has compiled tables of measurements, lists of localities, and descriptions of specimens from many sources. Seven new forms are described: *Lutra brunnea*, Pontianak, Borneo; *L. maculicollis kivuana*, Kissenje, Lake Kivu, German East Africa; *L. tenuis*, Lake Mohasi, German East Africa; *L. intermedia*, Sumatra; *L. lutra ceylonica*, Nuwara, Ceylon; *Amblyonyx cinerea fulvus*, Lao Key, Tonkin, Indo-China; and *Aonyx microdon*, Dorf Bomse, Kamerun, Africa.

The name *Latax lutris gracilis* Bechstein, 1800, is revived, erroneously, to replace *Latax lutris nereis* Merriam, 1904. Bechstein's name was based upon the "slender otter" of Pennant, described from "Staten-Land." Dr. Leonhard Stejneger has called the reviewer's attention to the fact that the Staten-Land of Pennant is without doubt the most southern island of the Kurile group, north of Japan; so named by its discoverer, de Vries, a Dutch navigator, in 1643. The name *gracilis* for a sea-otter is thus a synonym of *lutris*. In this connection it

might be well to call attention to the fact that the proper generic name for the sea-otters is *Enhydra* Fleming, 1822.

The latter half of the paper includes chapters on the morphology of the skull, the history and distribution of the groups, a synopsis of the classification of otters, and a rather extensive list of titles.

—*N. Hollister.*

Akeley, Carl E. Elephants. World's Work, vol. 41, pp. 73–92; 19 figs. November, 1920.

——— The autobiography of a taxidermist. World's Work, vol. 41, pp. 177–195; 24 figs. December, 1920.

——— My acquaintance with lions. World's Work, vol. 41, pp. 277–288; 9 figs. January, 1921.

——— Hand to hand with a leopard and some experiences with rhinos. World's Work, vol. 41, pp. 393–402; 8 figs. February, 1921.

——— Hunting the African buffalo. World's Work, vol. 41, pp. 497–504; 8 figs. March, 1921.

——— Bill my Kikuyu gun-bearer, and some of our adventures together in East Africa. World's Work, vol. 41, pp. 594–607; 18 figs. April, 1921.

Ames, H. T. Wolves and foxes plentiful. Wisconsin Conservationist, vol. 3, no. 1, pp. 15–16. March, 1921. (Claims increase in numbers of foxes, coyotes, and wolves in Wisconsin.)

Anthony, H. E. New mammals from Jamaica. Bull. Amer. Mus. Nat. Hist., vol. 42, pp. 469–475; 1 plate and 4 figs. December 11, 1920. (New genera and species of fossil rodents: *Clidomys osborni*, *C. parvus*, *Spirodontomys jamaicensis*, *Speozenus cundalli*, and *Alterodon major*.)

Barber, W. E. The blood-stained trail of the white-tailed deer in Wisconsin. Wisconsin Conservationist, vol. 3, no. 1, pp. 1, 2. March, 1921. (A plea for continuation of the "one buck law" in Wisconsin.)

Cabrera, Angel. El primer okapi vivo en Europa. Bol. Real Soc. española Hist. nat., vol. 19, pp. 443–445, 1 fig. October, 1919.

——— Dos ejemplares de "Ziphius" de las costas mediterráneas de España. Bol. Real Soc. española Hist. nat., vol. 19, pp. 468–470. December, 1919.

——— Dos nuevos murciélagos frugívorus. Bol. Real Soc. española Hist. nat., vol. 20, pp. 106–108. March, 1920. (New: *Rousettus* [*Lissonycteris*] *crypticola*, from Fernando Po; and *Dobsonia remota*, from New Guinea.)

——— Dos nuevas ratas de la isla de Borneo. Bol. Real Soc. española Hist. nat., vol. 20, pp. 211–213. July, 1920. (New: *Rattus melinogaster*, from Bongon, northern Borneo; and *R. trachynotus*, from Kina Balu.)

Cooper, A. R. Trematoda and Cestoda. Rep. Canadian Arctic Exped. 1913–18, vol. 9, part G-H, pp. 1–27, 2 plates. Ottawa, February 4, 1921. (Trematodes and cestodes collected in *Phoca*, *Erignathus*, and *Canis*.)

Depéret, Ch., and F. Roman. Le Felsinotherium serresi des sables pliocènes de Montpellier et les rameaux phylétiques des Siréniens fossiles de l'ancien monde. Archiv. Mus. d'Hist. Nat. de Lyon, vol. 12, Mémoire 4, pp. 1–56; pls. 1–7. 1920.

EKBLAW, W. ELMER. The ecological relations of the Polar Eskimo. Ecology, vol. 2, pp. 132–144. April, 1921. (Brief mention of mammals of Smith Sound, Greenland, and of their uses to the natives.)

EVERMANN, BARTON WARREN, AND HOWARD WALTON CLARK. Lake Maxinkuckee. A physical and biological survey. Pub. by Dept. of Conservation, Indiana. Vol. 1, pp. 1–660; vol. 2, pp. 1–512; numerous illustrations. (The list of mammals, pp. 452–480 of volume 1, includes 30 species. Many notes on distribution and habits.)

FIGGINS, J. D. A museum that photographs Nature. Municipal Facts, Denver, vol. 4, no. 4–5, pp. 9–13. April-May, 1921. (An account of the Colorado Museum of Natural History, with numerous figures of mounted groups.)

FISHER, A. K. The house cat. Outers' Recreation, vol. 64, no. 2, p. 84. February, 1921. (Account of destructive habits.)

GILLESPIE, T. H. Annual report of the Zoological Society of Scotland for the year ending 31st March, 1920. Pp. 1–20. 1920.

GREGORY, W. K. On the structure and relations of *Notharctus*, an American Eocene primate. Mem. Amer. Mus. Nat. Hist., n. s., vol. 3, pt. 2, pp. 49–243, pls. 23–59. September, 1920.

GUYER, M. F., AND E. A. SMITH. Studies on cytolysins. II. Transmission of induced eye defects. Journ. Exper. Zool., vol. 31, pp. 171–215; plates 1–4. August 20, 1920. (Account of the transmission through successive generations of eye defects in rabbits originally induced by means of lens-sensitized fowl serum.)

HAUSMAN, LEON AUGUSTUS. Hair coloration in animals. Scient. Monthly, vol. 11, pp. 215–222. March, 1921.

HINTON, MARTIN A. C. Some new African mammals. Ann. and Mag. Nat. Hist., ser. 9, vol. 7, pp. 368–373. April, 1921. (New: *Lutra maculicollis mulandæ* from British Ruanda; *Uranomys woodi*, Cholo, Nyasaland; *U. tenebrosus*, N'sana, Nyasaland; and *Cryptomys blainei*, Chisongwe, Luando River, Angola. The otter name is doubtless invalidated by one of Pohle's names, published in November, 1920, as noted above.)

HOLLISTER, N. The names for two genera of African Artiodactyla. Proc. Biol. Soc. Washington, vol. 34, p. 77. March 31, 1921. (The bush pigs now called *Potamochœrus* should be known by the name *Koiropotamus* Gray, 1843; and the correct name for the hartebeests is *Alcelaphus* Blainville, 1816.)

HOLLOWAY, E. Cheetahs on the Uganda railway. Journ. East Africa and Uganda Nat. Hist. Soc., no. 16, pp. 58–59. February, 1921.

HORNADAY, WILLIAM T. The fur trade and the wild animals. Zool. Soc. Bull., vol. 24, pp. 29–52; 21 figs. March, 1921.

JOHNSON, CHAS. E. Some recent observations on wild life conditions in the Superior Game Refuge. Fins, Feathers and Fur, no. 24, pp. 1–4. December, 1920. (Notes on game and fur-bearing mammals in Minnesota.)

LAROM, I. H. Elk season—1919 vs. 1920. Outers' Recreation, vol. 64, no. 2, p. 84. February, 1921. (From a letter dated November 19, 1920. Claims a decrease of 40 per cent in the northern elk herd.)

LAUT, AGNES. The sea otter and land otter. Forest and Stream, vol. 91, pp. 8, 9, 31. January, 1921. (General account of these species and a plea for the preservation of the land otter.)

LAUT, AGNES. Concerning beaver and nutria. Forest and Stream, vol. 91, pp. 57, 88, 89. February, 1921. (History of the trade and description of the fur).

LECHE, WILHELM. Morphologisch-geographische Formenreihen bei den Säugetieren. Lunds Univ. Årsskrift, vol. 16, no. 10, pp. 1–76; 11 figs. 1921.

LITTLE, C. C. Factors influencing the growth of a transplantable tumor in mice. Journ. Exper. Zool., vol. 31, pp. 307–326. October 5, 1920.

LODGE, WALTER L. Methods of saving Alaska game. Forest and Stream, vol. 91, pp. 156, 157, 188. April, 1921.

LOVERIDGE, ARTHUR. Notes on East African Mammalia (other than horned ungulates) collected or kept in captivity 1915–1919. Part I. Journ. East Africa and Uganda Nat. Hist. Soc., no. 16, pp. 38–42. February, 1921.

MARTELLI, GIOVANNI. Contributo alla conoscenza della vita e dei costumi della Arvicole in Puglia. Boll. Lab. Zool. Gen. et Agr. R. Scuola Super. d'Agric, in Portici. vol. 13, pp. 193-316. 1919. (Habits and economic status of *Pitymys savii*, *Apodemus sylvaticus*, and *Arvicola musignani*.)

MCATEE, W. L. The "one-letter" rule for generic names in zoology. Amer. Nat., vol. 55, pp. 89–96. February, 1921. (An able defense of the one-letter rule.)

MCGUIRE, J. A. In the Alaska-Yukon gamelands. Pp. 1–215; 16 plates. Stewart and Kidd Co., Cincinnati. $3 net. 1921. (An account of the hunting trip to the White River, Alaska-Yukon boundary, on which the type specimen of *Rangifer mcguirei* Figgins was obtained. Introduction by William T. Hornaday.)

MILLER, GERRIT S., JR., AND N. HOLLISTER. Descriptions of sixteen new murine rodents from Celebes. Proc. Biol. Soc. Washington, vol. 34, pp. 67–76. March 31, 1921. (New: *Echiothrix centrosa*, *E. brevicula*, *Rattus musschenbrœkii tetricus*, *R. raveni*, *R. r. curous*, *R. palelæ*, *R. hoffmanni linduensis*, *R. h. subditivus*, *R. mollicomus*, *R. adspersus*, *R. nigellus*, *R. penitus*, *R. sericatus*, *R. rallus*, *R. hellwaldii localis*, *R. h. cereus;* all collected by H. C. Raven, on expeditions under the direction of Dr. W. L. Abbott, for the Smithsonian Institution.)

NELSON, E. W. The big game of Alaska. Bull. Amer. Game. Protective Ass., April, 1921. Reprint, pp. 1–7; 6 figs. 1921. (Address before the Seventh National Game Conference, New York City, January, 1921.)

NORTHCOTE, G. A. S. Baboons attacking children. Journ. East Africa and Uganda Nat. Hist. Soc., no. 16, pp. 60–61. February, 1921.

PATON, JAMES S. Observations on the grizzly. Forest and Stream, vol. 91, pp. 155, 188. April, 1921.

PECK, ROBERT B. The renaissance of the beaver. Forest and Stream, vol. 91, pp. 152–154, 182–187. April, 1921. (Success of introductions in the Adirondacks.)

POCOCK, R. I. The systematic value of the glans penis in macaque monkeys. Ann. and Mag. Nat. Hist., ser. 9, vol. 7, pp. 224–229, 2 figs. March, 1921. (Revives the generic names *Lyssodes*, for *Macaca speciosa* and *M. fuscata*, and *Zati*, for *M. sinica*.)

———— A new species of Bassaricyon. Ann. and Mag. Nat. Hist., ser. 9, vol. 7, pp. 229–234, 2 figs. March, 1921. (Describes *Bassaricyon beddardi* from British Guiana.)

REAGAN, FRANKLIN P. On the later development of the azygous veins of swine. Anat. Record, vol. 17, pp. 111–125; 16 figs. November 20, 1919 (December, 1919).

ROBERTS, THOMAS S. Zoological Museum of the University of Minnesota. Annual Report. Extract from Report of the President of the University for the fiscal year ending June 30, 1920. 7 pages and 4 plates, unnumbered. 1921. (Half-tones of groups of large mammals.)

ROBINSON, HERBERT C. Two new Indo-Malayan rats. Ann. and Mag. Nat. Hist., ser. 9, vol. 7, pp. 234–236. March, 1921. (New: *Rattus bandahara*, from Kina Balu, Borneo; and *R. panglima*, from Palawan, P. I.)

ROHWER, S. A. The nomenclature of supergeneric names. Journ. Washington Acad. Sci., vol. 11, pp. 106–109. March 4, 1921.

RUTLEDGE, ARCHIBALD. The otter: playboy of Nature. Country Life, vol. 38, no. 6, pp. 106, 110, 112, 114. October, 1920. (Account of otters in South Carolina.)

———Hunting deer in Dixieland. Forest and Stream, vol. 91, pp. 53–56, 91. February, 1921.

———Vendettas of the marsh. Outlook, vol. 127, pp. 379–332. March 9, 1921. (Contains notes on habits of the raccoon and white-tailed deer in South Carolina.)

SHUFELDT, R. W. Woodchucks and porcupines. Amer. Forestry, vol. 27, pp. 147–154, 180; figs. 1–15. March, 1921.

———The extermination of mammals. Their economic value; and their great importance to man through the study of their comparative anatomy. Med. Record, reprints pp. 1–20. May 7, 1921.

SOWERBY, ARTHUR DE C. Notes on the East Asiatic members of the species Sciurus vulgaris, Linn., with descriptions of two new subspecies. Ann. and Mag. Nat. Hist., ser. 9, vol. 7, pp. 249–254. March, 1921. (New: *Sciurus vulgaris coreæ*, Corea; and *S. v. chiliensis*, Chihli, China.)

STOCKARD, CHARLES R. A remarkable explanation of polyembryony in the armadillo. Amer. Nat., vol. 55, pp. 62-68. February, 1921.

THOMAS, OLDFIELD. On a new genus and species of shrew, and some new Muridæ from the East-Indian Archipelago. Ann. and Mag. Nat. Hist., ser. 9, vol. 7, pp. 243–249. March, 1921. (New genus, *Crossogale*. New species, *Crossogale sumatrana*, Sumatra; *Rattus dominator*, Minahassa, Celebes; *R. bontanus*, South Celebes; *R. marmosurus*, Minahassa, Celebes; *R. dammermani*, Wadjo, Celebes; *R. pesticulus*, Menado, Celebes; *Uromys talaudium*, Talaud Islands.)

———New foxes of the genera Cerdocyon and Pseudalopex from northern Argentina. Ann. and Mag. Hist., ser. 9, vol. 7, pp. 381–385. April, 1921. (New: *Cerdocyon tecumanus*, *C. thous jucundus*, and *Pseudalopex zorrula*.)

———On the cavies of the genus Caviella. Ann. and Mag. Nat. Hist., ser. 9, vol. 7, pp. 445–448. May, 1921. (Three new subspecies of *Caviella australis*.)

———New Sigmodon, Oryzomys, and Echimys from Ecuador. Ann and. Mag. Nat. Hist., ser. 9, vol. 7, pp. 448–450. May, 1921.

TOYCEN, GEORGE. One buck's idea of a one-buck law. Wisconsin Conservationist, vol. 3, no. 1, p. 9, March, 1921.

[VON BURG, G.] Von den schweizerischen Eichhörnchen. Der Weidmann (Bülach-Zürich), Jahrg. 1920, no. 48, p. 387. December 2, 1920. (New name: *Sciurus vulgaris subalpinus*.)

————Schweizerische Wiesel und Hermeline. Der Weidmann, Jahrg. 1920, no. 48, pp. 387–388. December 2, 1920. (New names: *Putorius ermineus alpestris* and *P. e. giganteus*.)

————Das boralpen Eichhörnchen. Der Weidmann, Jahrg. 1920, no. 51, p. 408. December 23, 1920. (Further remarks on his *Sciurus vulgaris subalpinus*.)

————Hermeline aus dem oberen Engadin. Der Weidmann, Jahrg. 1920, no. 51, p. 409. December 23, 1920. (The name *Putorius boccamela alpinus* is proposed for the ermine of the upper Engadin.)

————Münstertaler Siebenschläfer. Der Weidmann, Jahrg. 1920, no. 52, p. 419. December 30, 1920. (*Glis glis subalpinus*, provisional name for a specimen of *Glis italicus*.)

————Hausratten. Der Weidmann, Jahrg. 1921, no. 1, p. 7. January 6, 1921. (New name: *Mus rattus jurassicus*.)

————Münstertaler Haselmäuse. Der Weidmann, Jahrg. 1921, no. 3, p. 6. January 20, 1921. (New: *Muscardinus avellanarius mustairensis*.)

————Eine neue Spitzmaus? Der Weidmann, Jahrg. 1921, no. 3, p. 6. January 20, 1921. (New: *Crocidura sufflavidentata*.)

————Hausmäuse aus den oberen Tessintälern. Der Weidmann, Jahrg. 1921, no. 6, p. 5. February 10, 1921. (New: *Mus musculus airolensis*.)

WARD, HENRY B. The conservation of game and fur-bearing animals. Science, n. s., vol. 53, p. 288. March 25, 1921.

WRIGHT, SEWALL, and PAUL A. LEWIS. Factors in the resistance of guinea pigs to tuberculosis, with especial regard to inbreeding and heredity. Amer. Nat., vol. 55, pp. 20–50. February, 1921.

CORRESPONDENCE

SEPARATE COPIES

To the Editor, Journal of Mammalogy:

May I appeal through you to my many friends among American mammalogists not to refrain from sending me separate copies of their papers in the Journal merely because they know I am a member of the Society, and therefore get the Journal.

Our great collection of separates here has been entirely built up out of the copies sent me, and these being arranged under author's names, and bound accordingly, the omission of contributions in the form of separates adds considerable probability to the chance of the papers being missed when work is done on the groups referred to, and certainly makes use far less convenient.

One has hitherto looked upon American naturalists as being the most liberal and the most certain in sending copies of their papers, but now alas the matter

is rapidly assuming quite a different complexion. I write in the first person in making this appeal but the question of course really affects all workers equally.

Yours, etc.

Oldfield Thomas.

British Museum (Natural History),
Cromwell Road, London, S. W. 7.
22nd February, 1921.

SAVE THE REDWOODS OF CALIFORNIA

Editor Journal of Mammalogy:

The Redwoods of California, *Sequoia sempervirens*, are among the oldest trees in the world. Their great size and height, the beauty of their feathery foliage, the grandeur and dignity of their towering trunks, the wonderful attractiveness of the half-lighted forest aisles give an impression which cannot be adequately described. That the inspiration of these things will be largely denied the generations of the future seems altogether likely unless prompt and adequate action is taken to preserve the Redwoods; for there are several important groves which, if they are to be saved at all, must be saved in 1921.

The pressing need for the preservation unspoiled of some fragments of wild nature is becoming increasingly apparent; and to few persons is this need more obvious than to the mammalogist or ornithologist who regularly takes the field. In California, Oregon and Washington, the far-reaching consequences of deforestation, which fall on the bird and mammal communities as well as on the trees, are all too evident. After the customary lumbering operations the landscape is a dreary and dismal place.

A determined effort inaugurated and led by Dr. John C. Merriam, of the Council of the American Society of Mammalogists, is being made to save some portions of the Redwoods. A non-profit corporation, the "Save the Redwoods League," has been organized, and it is proposed: (1) To rescue from destruction, for the enjoyment of this generation and those to come, adequate tracts of the *Sequoia sempervirens*, or Redwoods. (2) To establish through Federal aid a National Redwood Park, and through State aid a State Redwood Park. (3) To purchase Redwood groves by private subscription, and to establish memorial groves for individuals and organizations. (4) To obtain the protection of timber along the State highways now in course of construction in California. (5) To urge the State to purchase cut-over Redwood areas for reforestation.

Tangible accomplishments in which the League has had some part during the past year include the expenditure of over $100,000 in saving redwood groves along the State Highway in California, establishing a memorial grove to Colonel Raynal C. Bolling, the first American officer of high rank to fall in the World War, securing delay in cutting of areas designed for preservation, obtaining options on Redwoods lands along the South Fork of the Eel River (California), financing a survey for a National Redwood Park, gathering data for future use regarding the Redwood resources of the State, and engineering an effective publicity campaign. A strong organization has been built up and more than four thousand individuals have joined the League already.

Ultimately the League intends to secure a complete Redwood survey, including information concerning both species of Sequoia (*Sequoia sempervirens*, the Redwood, and *Sequoia gigantea*, the Big Tree). It is desirable that the birds and mammals of the Redwood habitat be investigated together with the trees. In view of Hofmann's findings (Ecology, vol. 1, 1920, pp. 49-53) regarding rodents and the reproduction of Douglas Fir one might almost expect to discover further significant relationships.

Those interested in the objects of the League can help by joining the organization, and promoting the prosperity of the movement in other ways. The Secretary-Treasurer of the League is R. G. Sproul, University of California, Berkeley, California; the dues for annual members are two dollars a year. It would seem appropriate that the American Society of Mammalogists take official cognizance of this movement and offer the encouragement of its moral support at least through the medium of resolutions adopted at the next annual meeting.

Walter P. Taylor.

Biological Survey, La Jolla, California.

THE THIRD ANNUAL MEETING OF THE AMERICAN SOCIETY OF MAMMALOGISTS

The third annual meeting of the American Society of Mammalogists was held in the United States National Museum, Washington, D. C., May 2–4, 1921, with 67 members in attendance,—approximately ⅓ of the total membership of the Society. Among other business matters it was voted that the Society affiliate with the American Association for the Advancement of Science; and that two additional committees be appointed: one on Marine Mammals; the other on Economic Mammalogy. Prof. E.-L. Trouessart, Muséum National, Paris, France, was unanimously elected an Honorary Member. The following rule was adopted by the Society: Rule III. Delinquents. A. Members whose dues are in arrears for more than one year shall not be entitled to receive the Journal of Mammalogy. B. The names of members whose dues are in arrears for more than two years shall be presented to the Directors for action.

The report of the Corresponding Secretary showed a total of 527 members in the Society, of which 99 were elected at the present meeting, and 41 were delinquent for 1920 dues. There had been 2 deaths and 11 resignations since the last annual meeting. The total distribution of the Journal of Mammalogy, including subscriptions, May 3, 1921, was 550.

The Society can take pride in having established a creditable magazine without a single financial donation toward its publication or general expenses. This has been done at a critical period in industrial history and at a time when printing costs were almost prohibitive. It has been possible, however, largely through the Charter Members, who willingly paid membership dues for the year 1919, yet received only one number of the Journal during that year. With a normal increase in the number of members and subscribers we can hope to continue to publish under present conditions between 200 and 250 pages and 10 half tones a year. Indications are that we shall soon be receiving first-class manuscript in

quantity sufficient to publish 400 pages a year. Is the Editor to be placed in a position where it will be necessary for him to refuse valuable contributions? It would seem that the Society could ill afford to sanction such a predicament. Diffusion of knowledge is as essential as its creation. Immense endowments are given to be devoted to research, investigations, and explorations. Comparatively small sums set aside as permanent publication funds would make available some of the results now buried in manuscripts. It is, therefore, essential to the best interests of the Society, the Journal, and everybody concerned, that definite and positive action be immediately taken to raise a Permanent Publication Fund. Any amount raised would actually be worth double the amount to the Journal because of the assured increase in the number of subscriptions which would follow the improvement in the Journal.

The program follows:

MONDAY, MAY 2

10:00 A. M.

Meeting of the Board of Directors

Afternoon Session, 2:00 P. M.

1. Remarks on certain mammals of Panama. E. A. Goldman. Twenty minutes. Illustrated by lantern slides and specimens.
2. A singing mouse. H. H. Lane. Five minutes.
3. Disposition and intelligence of the orang-utan. W. H. Sheak. Fifteen minutes.
4. The California elk-drive of 1904. C. Hart Merriam. Fifteen minutes.
5. Some observations on beaver culture with reference to the National Forests. Smith Riley. Thirty minutes.
6. Progress in mammalogy during 1920. General discussion for members. Led by T. S. Palmer. Sixty minutes.

Evening Session, 8:15 P. M.

7. A motion picture record of the animal collections of the Washington and Philadelphia Zoological Parks. (Made with the camera invented by Carl E. Akeley.) Arthur H. Fisher.

TUESDAY, MAY 3

Morning Session, 10:00 A. M.

8. Geography and evolution as pertaining to the kangaroo rats of California. Joseph Grinnell. Twenty-five minutes.
9. Nerve-endings of the maculae and cristae acusticae. H. H. Lane. Ten minutes. Illustrated by chart and demonstrations.

Business Session, 10:45 A. M.

Afternoon Session, 2:00 P. M.

10. Life histories of African squirrels and related groups. H. Lang. Forty minutes. Illustrated by lantern slides.

11. (a) Meaning of California records for buffalo. (b) The range of mountain sheep in northern California. C. Hart Merriam. Fifteen minutes. Illustrated by lantern slides.
12. Habits of the mammals of Celebes and Borneo. H. C. Raven. Thirty minutes. Illustrated by lantern slides.

WEDNESDAY, MAY 4

Morning Session, 10:00 A. M.

13. Present status of some of the larger mammals of Canada. R. M. Anderson. Twenty minutes. Illustrated by lantern slides.
14. Observations on certain specialized structures of the integument of primates. (a) Carpal sinus hairs. (b) A sternal gland in the orang-utan. Adolph H. Schultz. Twenty minutes. Illustrated by lantern slides.
15. Improved methods of trapping small mammals alive. Vernon Bailey. (Presented by E. A. Goldman.) Fifteen minutes. Illustrated by traps and specimens.
16. Life-zones of southern Ecuador. H. E. Anthony. Thirty minutes. Illustrated by lantern slides.
17. Remarks on the distribution and relationships of the North American chipmunks. Arthur H. Howell. Twenty minutes. Illustrated by lantern slides.
18. Some significant features of economic mammalogy. W. B. Bell. Twenty minutes.

Afternoon Session

At 1:00 P. M. members and their wives were entertained at luncheon at the National Zoological Park by the administration of the park and the Washington members. A short business session followed the luncheon, and a trip through the park under the direction of the Superintendent, Mr. N. Hollister, closed what had been, in spite of inclement weather, a most interesting and enjoyable meeting.

Hartley H. T. Jackson.